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[OFFICIAL NOTICE.]

### The American Gas Light Association's Greeting to European Gas Engineers.

AMERICAN GAS LIGHT ASSOCIATION, OFFICE OF SECRETARY,
PROVIDENCE, R. I., June 5th, 1893.

*To the European Gas Engineers—Greeting:* The American Gas Light Association will hold its 21st annual convention in the city of Chicago, beginning on the date of Wednesday, October 18th, 1893. It would give the members of the Association great pleasure to meet there as many of the European gas engineers and managers as can make it convenient to be in attendance at the World's Fair at that time. It is suggested that all contemplating visiting the Fair arrange their visits so as to be in Chicago, if possible, at the time of this convention, when they will be most cordially welcomed by the Association and invited to attend the sittings of the body and participate in its discussions of papers presented.

Those engineers who cannot conveniently visit the World's Fair at that time, but must choose some other date, are respectfully requested to send their names and addresses, as soon as they arrive in America, to the AMERICAN GAS LIGHT JOURNAL, No. 32 Pine street, New York City, so that a committee from the Association may be made aware of their presence, and when they may be met, so that they may form the acquaintance of their professional brethren in this country and be made to feel less like a "stranger in a strange land."

A. E. BOARDMAN,
President.

A. B. SLATER, JR.,
Secretary.

## BRIEFLY TOLD.

THE PHILADELPHIA GAS BUREAU REPORT FOR 1892.—We are in receipt of a copy of the Second Annual Message of Mayor Stewart, of Philadelphia, which, as usual, also contains the annual report of Mr. James H. Windrim, Director of the Department of Public Works, together with the reports of the "Chiefs of Bureaus constituting said Department." Amongst the latter is the statement presented by Mr. William K. Park, Chief of the Bureau of Gas, respecting the practical working of the vast hive under his immediate charge. There can be no doubt about it that incandescent electric lighting has secured quite a foothold in the Quaker City, which standing can be easily traced to the high rate that is charged for gas; for it goes without saying that $1.50 per 1,000 cubic feet in a city of the first class is far too high for a gas, the average candle power of which is returned at less than 20 candles, even though the aforesaid gas was manufactured under the fostering care and zealous arm of a municipally directed paternity. We have neither desire nor intention to throw any discredit on the capability of the gentlemen who are the actual directors and managers of the physical section of the gas works, for it is our pleasant privilege to say that Mr. Windrim makes an excellent Director, and time has fully proven the worth of Chief Park and his well-trained staff of lieutenants. No; it is not in the practical operation of the plants that the fault is to be detected; rather in the diversion and conversion of profits resulting from their labors must the charge of incapacity lie. The gas consumers of Philadelphia have suffered long and strong, and one cannot fail to admire the equanimity with which they bear their ills and woes; although, on the other hand, it is barely possible that instead of regarding them with admiration we should look on them pityingly, for perhaps their lack of

loud complaining is born of the calm that is the near relative of despair. A look at the tables before us (these relate to the operations of the Bureau for the twelvemonth ended December 31, 1892), reveals the bald fact that during the year no less a quantity than 594,203,605 cubic feet of gas was taken up by or distributed for public purposes—that is, to the Bureaus of Police, Fire, Parks, Schools, Street Lamps (the latter absorbed 501,160,281 cubic feet), Public Buildings, etc., all of which was consumed at the expense of the credit of the manufacturing department and for which no payment was made by the different named departments, but which was really paid for by the consumers of gas on private account. As the total output for the year on all accounts is returned at 3,584,589,000 cubic feet, the gas used on strictly public behalf amounts to over 14 per cent. of the total, wherefore the ordinary consumer has the knowledge, pleasing or otherwise, that his gas has cost him at least 21 cents per 1,000 more than it ought, even under the $1.50 tariff. We know that we are threshing old and musty straw in alluding to this monstrous condition of public gas supply of Philadelphia, but possibly a re flailing of the mouldy matter may assist in stirring up an odor the stench of which might move even a Philadelphia Councilman to action. To go back to our reference to the spread or growth of electric incandescent lighting in Philadelphia, and coupling therewith the references to the abnormally high gas rate and the injustice which compels the ordinary consumer to bear all the burden of gas used on public account, it is surprising evidence of the hold that gas has for the convenience and comfort of the people, that the sendout for 1892 exceeded the sendout for the preceding year by 172,702,000 cubic feet. A further examination of Chief Park's presentment goes to show that while many needed improvements on the plant were completed in 1892, the stern necessity that speaks for betterments of a nature both extensive and expensive is only too patent. In his concluding paragraph, which deals chiefly with the improvements and extensions contemplated for the current year, there is confession of inability—traceable only to the unwillingness of the city of Philadelphia to expend a further miserably small sum in excess of the appropriation for the year on a plant that is a veritable gold mine—that is absolutely painful. Having mentioned the items of the betterments, the Chief says: "To this would be added, if there were sufficient money, the substitution of a new shell for one of the holders at the Twenty-fifth and Callowhill streets station, now by reason of age practically useless." What think you, reader, of this? "If there were sufficient money!" And we venture the assertion that $25,000 would be more than the sum needed to restore the Callowhill street holder to a condition of usefulness. This is municipal management with a vengeance; and the everyday gas man would be justified in styling it ridiculous mismanagement. Perhaps a better day is in store for the control of Philadelphia's gas supply; nor can it come too quickly.

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OUR GERMAN BRETHREN AND THE WORLD'S FAIR.—Despite the prediction made some weeks ago by our contemporary, the *Journal of Gas Lighting*, that European engineers generally would not take much interest in the Columbian Exhibition, we beg leave to say that all our advices are quite to the contrary; further, we are certain that a reasonably large representation of the foreign guild will visit America and the Fair towards the close of August—and that the representation is to include several noted English engineers. They will be heartily welcomed. Meanwhile we have pleasure in publishing the following letter, which explains itself:

KARLSRUHE, July 3, 1893.

To the Editor AMERICAN GAS LIGHT JOURNAL:

Referring to the invitation of the American Gas Light Association, which is published in your JOURNAL, and a copy of which was also forwarded to me by Mr. A. B. Slater, Jr., Secretary of the Association, I beg to inform you that I expect to leave Hamburg on the 13th inst., whence the likelihood that I will be in New York one week later. I will not fail to call personally on you in order to become acquainted with our American colleagues, and to ask for the aid you have so fraternally offered us. In the meantime I beg to send the inclosed card of introduction and approval which we will give to the members of our German Gas Association who intend to visit America.

Very truly yours, DR. H. BUNTE.

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DEATH OF MR. ANDREW A. SMALLEY.—Mr. Andrew A. Smalley, for many years President of the Citizens Gas Light Company, Newark, N. J., died on the morning of Saturday, July 8th. Deceased, who was in his 79th year, organized the Citizens Gas Light Company in 1868, and successively served it as Treasurer and President. He retired from the Company's management in 1892. He was for years prominent in the business life of Newark. A wife and daughter survive him.

## Rotary Engines and Their Application to Gas Exhaustion.

[A paper read by Mr. E. BRYAN DONKIN, at the Thirtieth Annual General Meeting of the Incorporated Gas Institute.]

Rotary engines have been designed in such an innumerable variety of forms that it would be impossible, in a paper of ordinary length, to enter into the details of construction of one-tenth of the most important ones only. It is therefore proposed to confine the remarks to the particular types which have more especially been used for gas exhausting.

The simplest of these—and no doubt the oldest type of rotary engine—is that which derives its action from the steam impinging direct upon the atmosphere, as in the engine proposed by Hero two thousand years ago, or upon blades or vanes, on the principle of the water wheel or turbine. The latter engines have been known for centuries; but on account of their extreme wastefulness of steam, they have not been adopted in practice. It has, however, now been proved that a steam turbine made on scientific principles will work economically; and Parson's latest steam turbine may be considered as a very good example of practical success from this point of view. Blast and exhaust fans (Fig. 1) are on this principle, and have been used for exhausting gas. Another type may best be described as 2 toothed wheels gearing together, and steam impinging upon the teeth, which are in contact—the wheels being boxed in to prevent the escape of steam in other directions (Fig. 2). From this primitive idea have sprung several hundred inventions, the shape and number of the teeth being varied; but all are on the principle of one or more wheels gearing together, and revolving upon parallel axes in a casing. Hence the term "chamber wheel gearing" is applied to this type, the best known examples of which for gas exhausting are the Jones exhauster and the Roots exhauster; but the principle was described in books on mechanics over 250 years ago, and a patent obtained by Ridge in 1791 (Fig. 3.) The type shown by Figs. 4 and 5 has a cylinder revolving either concentrically or eccentrically in an outer casing; and flap valves are moved either by the drum itself or by levers connected with it. In many of the designs on this principle, the cylinders are not circular; and slides are often used instead of flap valves. This type is hardly worth consideration for purposes of exhausting gas; but small steam engines constructed on this principle have been made to work. It is almost impossible to conceive two metallic surfaces coming into sudden contact many times a minute, without much noise and great wear and tear. A pump of this type (Fig. 4) is mentioned in a work of mathematics dated 1588, and Fig. 5 was patented by Dundonald in 1833. The type shown by Fig. 6 has a disc, rolling round two conical plates in a spherical or semi-spherical casing, and known as "disc" engine. Many of these machines worked well for years as steam engines, though rather uneconomical. Two of them were at work for several years as gas exhausters at the Chartered Gas Company's old station at Horseferry Road, Westminster. It is doubtful whether this type was designed previous to this century.

Fig. 7 has a cylinder, rotating in an outer casing, and carrying round a slide or slides, the ends of which are in contact with the inside of the external casing. This type is very old; and there is not any vast difference between that designed by Ramella in 1588 (Fig. 7) and Fig. 8, patented by Josiah Beale in 1848. Fig. 10 shows a rotary steam engine patented in 1838, and since as a gas exhauster. Almost the whole capacity of the casing is utilized, but the pulsation would be very great; and the fact of the slides being totally unbalanced, and each having to practically stop once in a revolution, renders it unlikely to work well. Fig. 11 is on the same principle; and also utilizes nearly the whole capacity of the casing. The pulsation is not great with an exhauster on this principle, as the slide moves nearly at a constant velocity; but the machine only worked quietly and well at low speeds, the parts being much out of balance.

One great idea of inventors of rotary engines has been that, by doing away with the crank of the reciprocating engine on to which the pressure of steam is transmitted at a varying angle, great power would be saved. This is, however, now well known to be a fallacy. Nevertheless, a rotary engine would have much in its favor could it be designed to work with economy, and be constructed at a moderate price, while still maintaining the high efficiency for wear and tear that the best types have at present. Exhausters have worked constantly for as long a period as 14 years, without being opened—*i. e.*, without any readjustment; but probably no one ever heard of a steam engine running much over a year continuously without requiring some repairs or adjustment. It must be remembered that 14 years' work as a gas exhauster generally means double this time when compared with the majority of machines.

It may be interesting to note the reason of such machines being a

practical failure as steam engines, and a complete success as gas exhausters. The greatest difficulty experienced in this type of engine is getting a steam tight joint between the slide or piston and the casing or other parts it has to work against. Thus, if Fig. 9 is examined, it will be seen that steam can leak under the internal cylinder at *A* and between the two end plates and the slide, between the top and bottom of the slide *B B*, and between the slide and the internal cylinder at *C C*. Now, to make these joints steam tight, at least 9 separate packing pieces with strong springs would be required, as it is practically impossible to make a sliding joint even fairly steam tight without pressure—especially as a certain amount of clearance must be allowed for the expansion of the metal. In practice, a number of packing pieces as described would be fatal to the working of such an engine, as the danger of a breakdown would be so much increased. It is therefore necessary to construct it without these, and with as little clearance as possible; the result of this being great loss of steam. Take an engine, for example, 2 feet in internal diameter and 2 feet wide. Supposing the clearance of each joint was only $\frac{1}{200}$th of an inch, this clearance would be equal to the area of a $\frac{3}{4}$-inch pipe; and steam blowing through this at (say) only 50 lbs. pressure, would be a very large proportion of the amount utilized as power. With the engine acting as a gas exhauster, the pressure being only 1 to 1½ lbs., the amount of leak back or slip would be reduced to $\frac{1}{30}$th or $\frac{1}{40}$th of the leak of steam in the former case; and this would form a very small proportion of the gas passed, and represent a very small amount of extra steam required to drive the exhauster, as such extra amount would be used expansively in the engine driving the exhauster, instead of blowing off into the open air, as in the rotary engine. It is found in practice that the tar in gas exhausters again diminishes the leak to a very considerable extent. The fact of the piston or slide opening and closing the gas inlet and outlet ports, so that no valves are required when used as an exhauster, gives an almost continuous flow, simplifies the machine, and makes it very suitable for the purpose.

The pump (Fig. 7) invented by Ramella in 1588, as before mentioned, appears to be one of the earliest attempts in the construction of rotary pumps. It is certainly one of the best designs, as is shown by the fact that the most modern forms of exhausters are constructed on the same principle, but with various improvements in the details. One exhauster, patented a few years ago, was precisely the same in every respect; and several of them were made, and worked fairly well. The weak point of this design is that the internal surface of the casing has to guide the slides—*i. e*, to force them in and out of the internal cylinder—causing great friction, and resulting in heavy wear and great absorption of power. If the slides of the pump are guided by segments running in circular grooves in the end plates, the friction is reduced and Ramella's pump then becomes a Joshua Beale's 1848 patent exhauster (Fig. 8) in every particular. Fig. 9, with two slides, one overlapping the other, instead of four (as claimed by him in the same patent), is one of the most ordinary type now used. Mr. John Beale improved upon this design by making the slide in one piece, with a small additional slide working in it (Fig. 12). The chief advantages of this patent are extra surface obtained in the internal cylinder, reducing the overhang of the slide when full out, and using rings instead of segments, increasing wearing surface and confining the friction to the inner circle only, whereas the segments are working one-half revolution on the inner circle and one-half on the outer circle. A very large number of these exhausters are in use. Mr. W. B. Wright's patent (Fig. 13) is on the same principle; but as the slides enter the internal cylinder at a tangent, greater wearing surface can be obtained.

If the slides are guided from a central pin (Fig. 14), it becomes Lord Cochrane's steam engine, patented in 1831. This was again patented in 1855, by Belford, as a ventilator, and by many others since for steam engines, pumps, blowers and gas exhausters. About 1860, Franchot, a Frenchman, designed an engine (Fig. 15) in which the slide remained always the same length; and to do this, the cylinder had to be made greater in its horizontal than in its vertical diameter. It had the same defect as Ramella's—viz., the slide being guided by the inner surface of the casing. Mr. John Beale, however, got over this defect by fixing a rotating block in the center of the exhauster (Fig. 16), carried on a horizontal fixed pin, and having two guides on the slide, which engage with the rotating block and guide the slide independently of the casing. The chief improvement in this latter exhauster of Beale's is that the slide is guided from the center of the exhauster, where the velocity is very low, instead of from the periphery, where the velocity is high, the difference being as 15 to 1 for the same number of revolutions. Besides this, a much greater surface for wear is obtained on the block than on the segments, and also more in the axle. The latest development in exhausters of this type (patented 1892) is utilizing the space occupied by the internal cylinder, as shown by Fig. 17. This gives an increase of capacity of about 45 per cent. for the same size of exhauster at the same speed, without adding to the working parts. Another important advantage of this latter patent is the increased steadiness of gauge. It will be seen by Fig. 16 that, while the slide in the casing is vertical, it is forcing out more gas than when in its horizontal position, thereby causing pulsation. But by utilizing the internal cylinder in the manner shown (Fig. 17), its contents have hardly begun to be discharged during the period of maximum discharge of the main slide; and while this main slide is discharging its minimum, the internal cylinder is discharging its maximum.

Many efforts have been made, with more or less success, to obviate the pulsation caused by gas exhausters—generally by increasing the number of slides. This certainly does away to a certain extent with the pulsation, as the puffs of gas come nearer together, and therefore the pressure has not time to fall so low. As a matter of fact, however, this pulsation is not so much due to these outward puffs of gas as is generally supposed, or by the sudden opening and shutting of the ports by the slide; but it is chiefly owing to the gas passing back from the outlet into the exhauster when the slide has just opened the outlet port. Looking at Fig. 16, it will be seen that the gas in the exhauster when both ports are shut is really in a state of tension, due to the vacuum on the inlet side, the gas in the outlet being under pressure. Therefore, directly the slide moves down and opens the outlet port, the gas under pressure passes back into the exhauster, where there is no pressure. This happens in all exhausters of this type, independently of the number of blades. With the new type of exhauster (1892 patent), Fig. 17, it will be seen that, just at the moment the gas is passing back from the outlet into the exhauster, it is met by a stream of gas from the internal cylinder, and this to a great extent decreases pulsation. Diagrams Nos. 1 and 2, taken from an exhauster on each type, by a steam engine indicator, clearly show that this happens in practice.

These diagrams were taken in the following manner: A disc of wood covered with paper was secured to the end of the crankshaft of the engine, so that it revolved in a vertical plane, each revolution representing one revolution of the exhauster. A steam engine indicator, with a very light spring, was placed in front of the disc, and connected by a pipe to the outlet of the exhauster. Before the cock admitting the pressure from the exhauster to the indicator was turned on, the pencil was placed against the revolving disc; and, of course, it described a circle, called on the diagram "Atmospheric Line." The pressure then being admitted to the indicator, and the pencil again brought to the disc, the curve showing the variation of pressure throughout the whole of one revolution was described. It will be seen that in Diagram No. 1, directly the slide opens the outlet port, the pressure at *A* begins to decrease, until it reaches about .2-inch pressure, which is due to the gas passing back from the outlet into the exhauster. As the slide moves round, the pressure again increases until it reaches *B*, which is about 1.5 inches pressure, and then gradually decreases as the slide forces out less gas.

In Diagram No. 2, as the slide opens, the pressure remains about the same, because the full capacity of the internal cylinder is being discharged. It then drops, but only to about 1-inch pressure. It again rises to about 1.5 inches, and keeps averaging the same till the slide closes, the line much more nearly approximating a circle than in Diagram No. 1. The maximum pressure in No. 1 Diagram being 1.5 inches and the minimum 0.2 inch, the difference is 1.3 inches, or 650 per cent. increase of pressure in each half revolution; whereas, in Diagram No. 2, the difference of pressure is 0.5 inch, or 50 per cent. increase only.

Apparently the proper principle to obtain steadiness of gauge, would be to have a swing retaining valve in the outlet port of the exhauster, fitting against the slide; so that the latter would not open the outlet port until the gas was compressed in the exhauster itself to an equal pressure with the gas in the outlet. It is, however, unnecessary in practice to go into such refinements, as the outlet gauge of modern exhausters is usually quite steady enough for the purposes required in gas works; and it is the inlet or vacuum gauge which is the more important. In the table of experiments made by Mr. J. W. Helps, of Croydon, it will be seen that the pulsation shown by the inlet gauge of this new exhauster is reduced to a minimum, due to the reasons just given for the increased steadiness of the outlet gauge.

Bye-passing gas from the outlet to the inlet, both in the exhauster itself and outside, has often been resorted to to decrease the pulsation; but to have any very marked effect at least one-third of the gas must be bye-passed. This means doing one-third of the work twice over, or, in other words, using 33 per cent. more steam or fuel than is necessary, and increasing the wear and tear of the exhauster in proportion. Consequently it may be considered a very clumsy way of getting over the

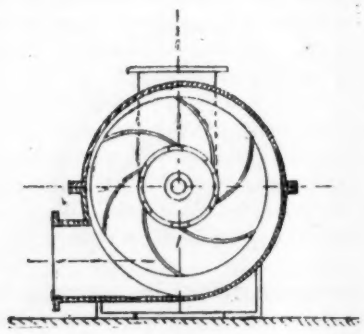


Fig. 1.

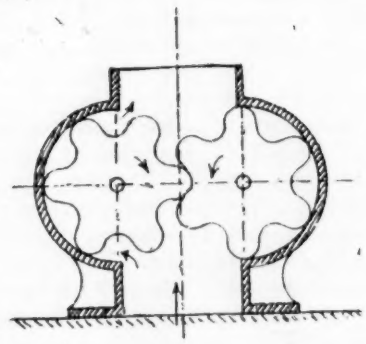


Fig. 2.

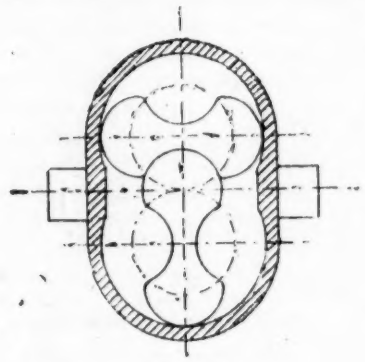


Fig. 3.

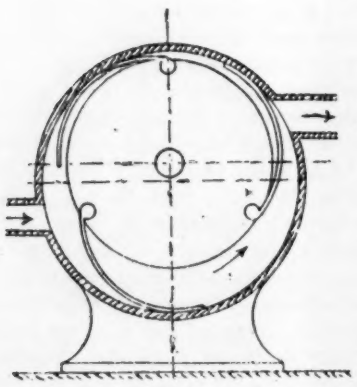


Fig. 4.

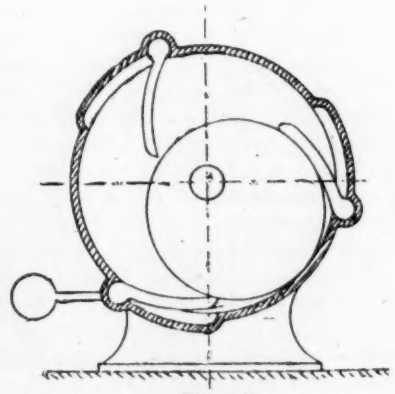


Fig. 5.

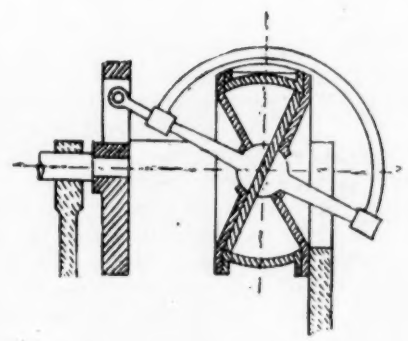


Fig. 6.

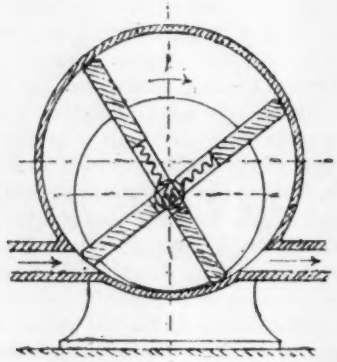


Fig. 7.

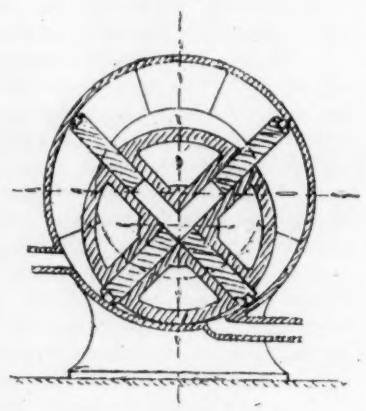


Fig. 8.

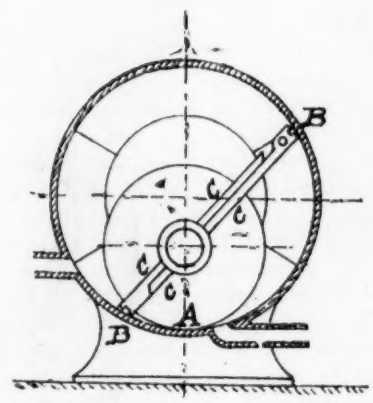



Fig. 9.

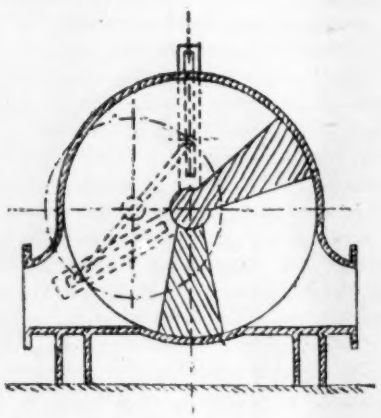


Fig. 10.

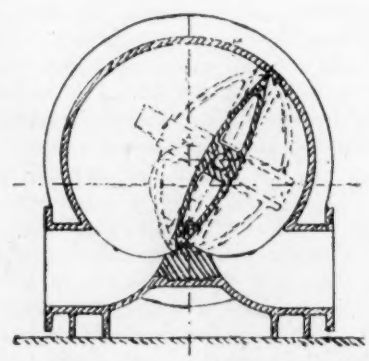


Fig. 11.

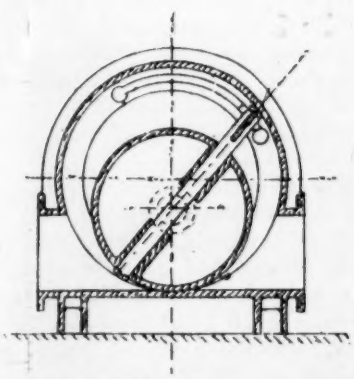
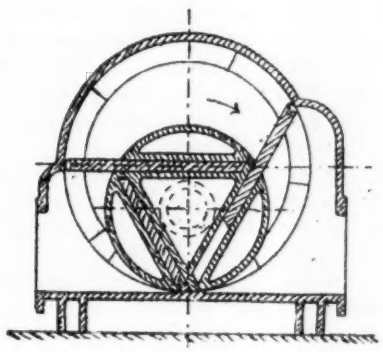


Fig. 12.

difficulty. Besides this, bye passing has a great drawback—viz., churning up the gas in the exhauster, leaving hard pitch in the working parts, and causing the solvent properties of the tar to be carried away with the gas, thus ruining the exhauster, generating heat, and absorbing power uselessly. It may here be remarked that, where trouble is experienced from the formation of pitch, a small quantity of paraffine may be pumped into the exhauster now and then, and always before starting or stopping the machine.

Some of the movements in these rotary engines may appear complicated; but the study of mechanics greatly helps a practical man in working out such movements. For example, if Fig. 18 (a well-known form of pump and engine combined) is examined, and compared with the exhauster in Fig. 16, it would probably not be noticed that there was any connection between the movements of the two—one appearing much simpler than the other—and it would take some time and trouble to trace the connection. But a slight knowledge of kinematics would enable the symbols used to be applied; and it would be found that the symbol is is the same for the chain of movements of both machines. It is easy to show the connection practically by a moving diagram, in which it is merely necessary to fix the crank-pin of a reciprocating engine and



Fig, 13.

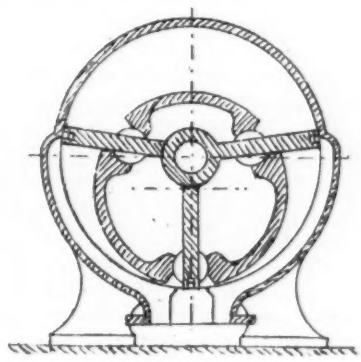


Fig. 14.

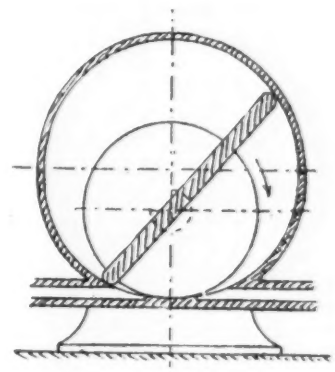


Fig. 15.

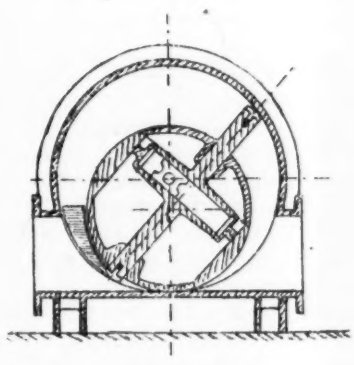


Fig 16.

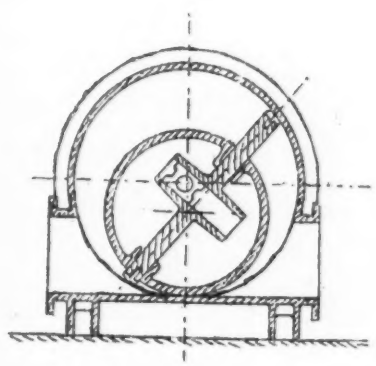


Fig. 17.

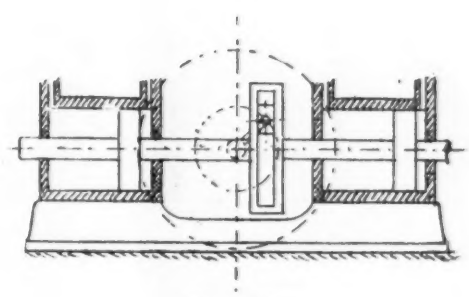


Fig. 18.

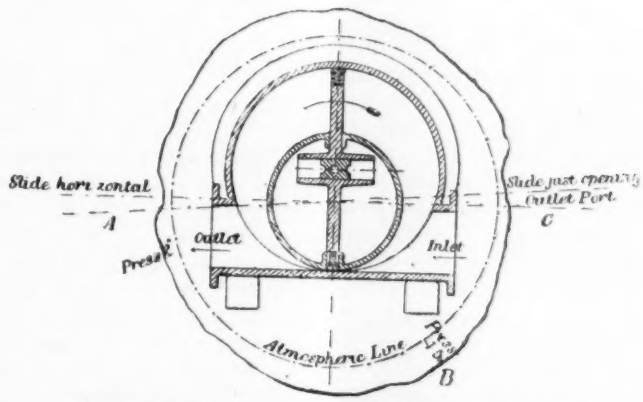



**Diagram No. 1.**—Ordinary Exhauster, 1877 Pattern.
Pressure by gauge, about 1 inches of mercury;
revolutions, 126 per min.

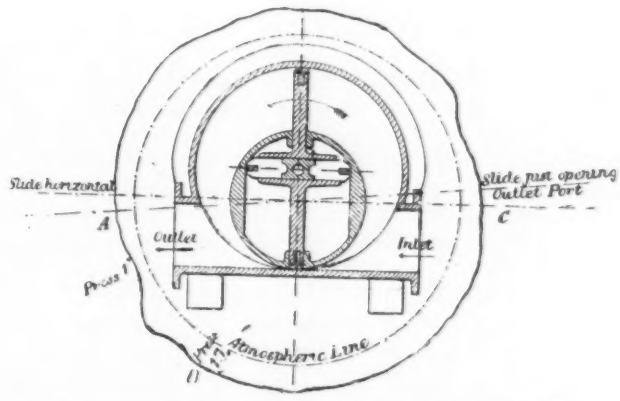



**Diagram No. 2.**—Compound Exhauster, 1892 Pattern.
Pressure by gauge, about 1.5 inches of mercury;
revolutions, 130 per min.

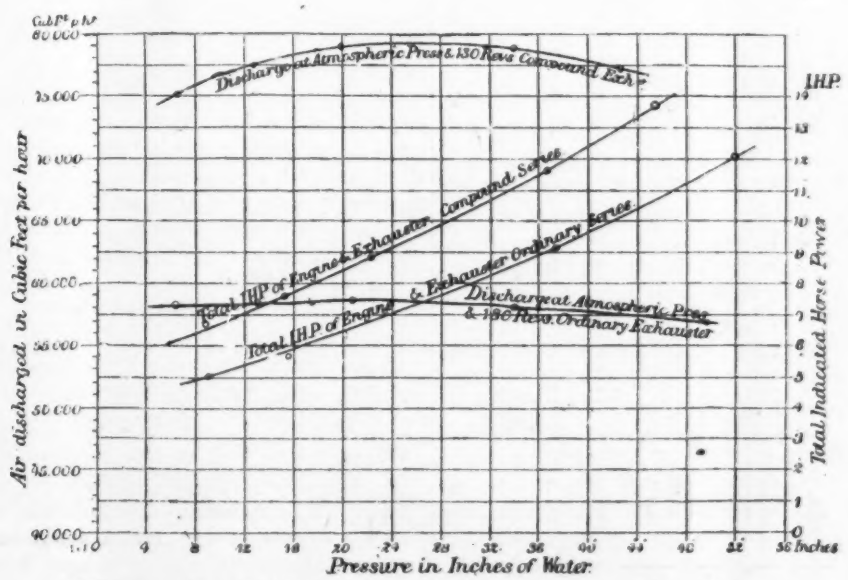

Cub. Ft. p. hr.
80 000
75 000
70 000
65 000
60 000
55 000
50 000
45 000
40 000
Discharge at Atmospheric Press. & 130 Revs. Compound Exhr.
Total I.H.P. of Engine & Exhauster Compound Series
Total I.H.P. of Engine & Exhauster Ordinary Series
Discharge at Atmospheric Press. & 126 Revs. Ordinary Exhauster
I.H.P.
Air discharged in Cubic Feet per hour
Total Indicated Horse Power
0 4 8 12 16 20 24 28 32 36 40 44 48 52 56 Inches
Pressure in Inches of Water.

**Diagram No. 3.**—Experiments on 50,000 feet Exhauster, by Mr. Helps.
(See accompanying Table.)

*Experiments on a 50,000 Cubic Feet Exhauster, conducted by Mr. J. W. Helps, of Croydon, Feb. 15, 1893.*

Air measured through circular holes in discs. Indicated horse power of engine alone, at 130 revolutions = 1.38. Barometer = 29.78 in.

| No. of Experiment. | Revs. per Min. | Total I.H.P. Engine + Exhauster. | Mean Vacuum at Inlet. Inches of Water. | Mean Pressure at Outlet. Inches of Water. | Total Pressure = Vacuum + Pressure. | Area of Outlet. Sq. Ft. | Quantity of Air Discharged, in Cubic Feet per Hour. | | Air Discharged at Atmospheric Pressure, and 130 Revs. p. Min. Cu. Ft. per Hour. | Theoretical H.P. of Air Discharged. | Percentage Theoretical H.P. of Total H.P. | Difference between Total and Theoretical H.P. in Percentage of Theoretical. | Diameter of Hole at Outlet. Inches. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | At Speed of Expt.* | At 150 Revs. per min. | | | | | | |
| 1 | 129.6 | 5.04 | 2.50 | 6.27 | 8.77 | 0.14806 | 57,220 | 57,400 | 58,280 | 1.317 | 26.1 | 283 | 5.21 | Ordinary Exhauster. (1877 Patent). Calculated capacity = 55,554 cubic feet per hour at 130 revolutions per minute. |
| 2 | 129.4 | 5.75 | 2.59 | 13.05 | 15.64 | 0,10084 | 56,230 | 56,490 | 58,310 | 2.311 | 40.2 | 149 | 4.30 | |
| 3 | 130.1 | 7.04 | 2.57 | 20.53 | 23.10 | 0.08000 | 55,950 | 55,900 | 58,730 | 3.393 | 48.2 | 107 | 3.83 | |
| 4 | 128.4 | 9.08 | 2.58 | 33.92 | 36.50 | 0.05867 | 52,750 | 53,410 | 57,880 | 5.054 | 55.6 | 80 | 3.28 | |
| 5 | 130.8 | 12.04 | 2.58 | 49.43 | 52.01 | 0.04715 | 51,170 | 50,850 | 57,060 | 6.986 | 58.0 | 73 | 2.94 | |
| 6 | 130.5 | 6.71 | 2.54 | 6.275 | 8.815 | 0.19180 | 74,170 | 73,880 | 75,030 | 1.716 | 25.6 | 291 | 5.93 | Compound Exhauster. (1892 Patent.) Calculated capacity = 79,000 cubic feet per hour at 130 revolutions per minute. |
| 7 | 129.5 | 7.61 | 2.54 | 12.705 | 15.245 | 0.13582 | 74,730 | 75,010 | 77,360 | 2.990 | 39.3 | 154 | 4.99 | |
| 8 | 129.4 | 8.90 | 2.45 | 19.885 | 22.335 | 0.10900 | 75,020 | 75,370 | 79,070 | 4.398 | 49.4 | 102 | 4.47 | |
| 9 | 128.3 low. | 11.64 | 2.48 | 33.91 | 36.390 | 0.08000 | 71,910 | 72,860 | 78,970 | 6.870 | 59.0 | 70 | 3.83 | |
| 10 | 123.2 | 13.70 | 2.42 | 42.86 | 45.280 | 0.06557 | 66,360 | 70,020 | 77,430 | 7.888 | 57.6 | 74 | 3.47 | |

*Theoretical velocity = 67 $\sqrt{h}$, where $h$ = pressure in inches of water and velocity in feet per second.
Actual velocity assuming .64 coefficient = 42.88 $\sqrt{h}$ = velocity in feet per second, or 2,572.8 $\sqrt{h}$ = feet per minute.
Discharge in cubic feet per hour = 154,368 $\sqrt{h}$ × area in square feet.

pump and allow the cylinders to rotate on a fixed center, to give the motion of the exhauster (Fig. 16). Probably most of the various motions in rotary engines of all types were designed with great labor and without the knowledge of kinematics, by the help of which the required motions could have been arrived at much more easily; and to this want of knowledge may no doubt be attributed the constant repetition of invention of engines that are in principle the same.

The lubrication of exhausters is a most important point, as affecting their working and wear. In cases where the tar keeps in a thinnish fluid state, an exhauster requires hardly any lubrication; but if the small amount of oil necessary is not of the right quality, the result may be that it will be stopped altogether, or some of the parts so worn that they will have to be repaired in a few months. The chief thing is to find out what particular oil mixes and works well with the tar which is being passed through the exhauster, as the tar itself, being a good lubricant (or rather, containing good lubricating ingredients), should be retained in the exhauster. The great object is to keep the tar in a soluble state; and in most cases it is found that the lubricant termed "coal tar" oil does this effectually.

In pumping clean gas, however, as is often done now, the "coal tar" oil has not sufficient lubricating properties; and any good machine oil can be used. But it must be one that will not congeal at a low temperature, as the gas is being pumped from the holders at very little above atmospheric temperature; nor must the oil contain any impurities that the gas will take up. Whether pumping foul or clean gas, the most important point, when a right oil is obtained, is to see that it is thoroughly filtered, so that no dirt gets into the exhauster with it, as is very often the case; the result being stoppage or increased wear.

Regarding steam engines for driving exhausters, they should be as simple as possible, because in any case the engine is more liable to break down than the exhauster; and for the same reason, only high-class engines should be used. Single cylinder engines are preferable, on account of their simplicity, fitted with a single slide valve and rod, and no expansion gear. This latter, besides making the engine complicated, is unnecessary, as the power is not varying every few minutes to any extent. Feed or other pumps should also be avoided on the engine. Horizontal engines are perhaps preferable, as with vertical ones there is a tendency for the water to leak through the stuffing-box of the piston-rod at the bottom of the cylinder, making it difficult to keep the engine clean. All the parts of a horizontal engine are also more accessible for lubricating, examining, and keeping clean; and there is less tendency to vibration than with a vertical engine. Where economy of steam and fuel is an object, the cylinder and its covers should be steam-jacketed with boiler steam, effecting a saving of 15 to 25 per cent. This question of steam-jacketing has always been a disputed point; but the economy is now proved. The jacketing must, however, be properly carried out; otherwise it may have the reverse effect. A steam jacketed engine is also much easier and safer to start, as everything is warmer, which prevents an accumulation of water in the cylinder. If further economy is desired, the simplest plan is to have a separate jet condenser, air-pump and engine (or an air and water surface condenser outside the house, with air-pump and engine); and to connect the exhaust-pipes of all the engines to this condenser. Then, by having two valves, the engine can be worked non-condensing or condensing at a moment's notice—doing away with the extra risk of a breakdown, with an air-pump driven direct from the engine, and yet being able to work with a maximum of economy. The air and water surface condensers do not require quite so much water as ordinary jet condensers. If the steam pressure available is 60 to 80 lbs., a simply-designed compound engine, to work either non condensing or condensing, is very economical; but such engines are only advisable for driving exhausters of large size.

Those who take an interest in the construction of rotary engines cannot do better than study Professor Kennedy's translation of Realeaux's "Kinematics of Machinery," which is probably the most interesting and comprehensive book written on this subject, and to which the author is indebted for some of the older examples of engines.

In conclusion, the author trusts that, notwithstanding the simplicity and unscientific character of this paper, it may throw some light upon the construction of the machinery which may fairly be called the "heart" of a gas works. In writing it, he has been actuated by the hope that his personal experience on this subject may be of some value to the members of this Institute; and that the historical notes may prove of interest.

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THE residents of Malden, Mass., have petitioned the Board of Street Commissioners to cause the public lamps to be lighted each night and all night.

### The Utilization of Small Bituminous Coal.

The *Colliery Engineer* in editorial comment on this subject says that in the mining of bituminous coal some dust must inevitably be produced. As sent to market, coal has in the past been supposed to be passed over grids sufficiently open to remove the small and dust, and vast heaps of so called unsalable refuse have been burned at the pit mouth. It has been attempted to utilize such waste by mixing with it a proportion of tarry matter and compressing into bricks, which are sold as "patent fuel," but no great success has attended this. Dust fuel has not in the past been considered worth carriage, and yet, apart from the fact of its being dust, it is not when freshly produced inferior in calorific power to lump fuel. It certainly parts sooner with its hydrogen, and will not bear long storage as well as larger stuff; but when new it is not inferior. The problem is to find a sale for it at a price sufficient to yield a return to the miner and pay carriage.

In England the problem has attracted increasing attention for several years past, more particularly in the direction of mechanical methods of stoking. As regards the hand-firing of dust coal, it appears pretty well established that this cannot be done unless there is a sufficient grate area to admit of a rate of combustion not exceeding 12 pounds per square foot of grate per hour.

In France, where coal is expensive (and some of the best of the French coal is rather friable and produces much dust), the difference of price has been a sufficient inducement to secure the laying down of more extensive boiler plants in order to take advantage of this lower cost, and such outlay has well repaid itself. With the increasing cost of coal in England, the same inducement is now more strongly presented to steam users, and there has been quite a revival of the interest in mechanical stoking.

The question now at issue is the type of mechanical stoker to be employed—the coker or the sprinkler. In the sprinkling type of machine the fuel is distributed over the whole surface of the fire by means of revolving fans or spring-actuated shovels, and the result is a fire giving off flame for the whole of its area, and producing a continuous supply of smoke, not of a dense nature, but of very considerable amount when aggregated. Still the color comes under the head of "light," and unless the smoke ordinance is pretty rigidly enforced, this may pass muster, though in daily amount it exceeds the aggregate of the spasmodic bursts of black smoke from a hand-fired boiler.

In the coking type of machine the fuel is pushed by reciprocating plungers upon the bars, which have a motion into the furnace, either actually, being in the form of an endless belt, or in effect by an arrangement which draws the bars out a short distance, one after another, and pushes them forward again *en masse*.

A refractory arch usually covers the mouth of the furnace and assists to carbonize the freshly entered fuel, the gases from which pass over the red portion of the fire nearer the bridge and combine with the additional air which enters the furnace through the thinner parts of the fire, and the result is a smokeless chimney. The coking machine, in fact, aims to carry on continuously the process of combustion as it was practiced in the days of Watt, where the dead plate of a boiler furnace served the intended purpose of holding a mass of coal until it had parted with its volatile constituents, when it was pushed forward and spread over the grate, and its place filled by another barrowfull of coal upon the dead plate. This, the common sense and natural method of using bituminous fuels, is continuously effected in the modern coking stoker.

Perhaps the worst evil of the sprinkling system is the conveyance by the draft of so large a quantity of the finer dust over the bridge, into the tubes and flues and even out of the chimney top, whence it issues often half burned and covers the immediate vicinity with dust. In a coking machine this does not occur, for the green fuel swells and softens when heated at the dead plate and cements together, forming cakes and lumps which do not fall through the bars nor are they drawn away by the draft. It is evident, however, that as the fuel is burned away, the rear of the fire-grate will become bare and admit an excessive amount of air. Hence it is necessary to keep the fire-grate as short as possible, to maintain a fairly thick bed of fire and to carry on combustion as rapidly as possible, diminishing the possibly thinly covered back end to a minimum, whilst also making use of the excess of air admitted at that point, to effect the combustion of the hydrogens which come from the front end and are heated to ignition temperature, as they pass over the red and brightly burning fire. While the absolute fuel economy of a mechanical stoker is not claimed to be great, its better informed advocates confining themselves to a moderate five per cent., though perhaps frequently the percentage may be the other way, there may be shown a commercial economy of forty or fifty per cent. due to the employment of a cheap fuel, where hitherto the necessity of obeying the provisions of the London Smoke ordinance has compelled the use of best Welsh coal at double price, an extravagance which makers of mechanical stokers consider entirely unnecessary. With the increase of mecanical stoking small fuel will obtain an enhanced price, and that of large smokeless coal will at least be retarded in its rise, so that there will be a tendency to limit the use of the machines as the economy to be effected is narrowed. Mechanical stokers of the coking type have been very effectively employed to burn a mixture of fine coal and breeze—breeze being the dust sifted out of gas coke. The addition of the dust coal gives the necessary coking action to cement the coke into a mass and the economy is most marked. To be seen to best advantage, however, a mechanical stoker should only be used in combination with a mechanical conveyer to carry the coal from the heap, and place it in the hoppers of the stoker.

While the coal has to be thrown into the hoppers by hand, a large amount of dust is made and blown about, the work of the fireman is doubled and he is made dirty and uncomfortable, and naturally detests a machine which loads him with a double toil. With the conveyers this is avoided and cleanliness ensured.

It is perhaps unfortunate that no mechanical stoker yet made adds to the good appearance of a boiler of Lancashire type, which is the English boiler *par excellence*. This question to appearance has quite a considerable weight with some steam users who take a pride in the appearance of their boiler houses. Nevertheless, mechanical stoking is making steady progress and will continue to do so as public opinion becomes more exacting in respect to smoke production.

Gas as fuel, which a few years ago was so strongly boomed has retired into the background and is now very little heard of except as a supply for gas engines. It is certain, however, that a good gas producer and suitable boiler would present an excellent means of using inferior fuels for steam generative purposes if some inventor would only show a really good article. As regards the rate of combustion attained with mechanical stokers, this is claimed as high as 36 pounds per square foot with a good draft.

The high rate is probably due to the constant movement of the bars, and the fact that this keeps open the air spaces.

It is said by some that more duty can be got with stokers of the sprinkling type than with those of coking type, but advocates of the latter dispute this. There are good reasons to believe that the best results are to be obtained where the rate of combustion is highest, and the fire-grate is reduced to a minimum area, a good draft being employed and the fire kept thick. A good draft, however, is a very wasteful commodity, when applied to a grate of excessive area only partially covered with fire, and this is what the inferior fireman seems to enjoy and what he will object to exchange for a well covered grate. On a big grate admitting excessive air very much of the coal is simply burned in order to heat up such excessive air; hence the wastefulness of this manner of working. The mechanical stoker makers find already quite sufficient wear and tear without adding unnecessarily to their grate length. They have, therefore, every inducement to proportion things upon a basis tending to economy.

[Concluded from page 47.]

[Prepared for the *Engineering Magazine* by Mr. S. S. GORBY, Indiana State Geologist.]

### Limits of the Natural Gas Supply.

Natural gas in commercial quantities is confined to limited areas, and, necessarily, it is limited in amount. As already stated, there is but one source from which the exhausted areas may be replenished, and that is from the petroleum confined in the same rock reservoirs. The conditions that prevail in the strata containing the petroleum are not favorable for a rapid generation of gas. The temperature of the rocks is too low. The temperature of the water in the deep wells of Ohio and Indiana is never found to be above 60° F. The average temperature of the water in the deeper wells is about 55°. This is much too low to produce a rapid transformation of petroleum into gas. It would require a temperature at least three times as high to produce a rapid generation of gas. The stock of gas now confined in the various reservoirs is all that can ever be made available for use. Even if there was a sufficient generation of gas from petroleum to keep up the normal pressure in the wells and mains, the stock of petroleum would finally be exhausted, and then the supply of gas would as certainly cease.

This one important fact is plainly apparent: The supply of gas for practical use is certainly limited. How long it may be made available for economic purposes must be decided in the future. Its permanency

depends largely upon the use made of it. For the past eight years it has been extravagantly and foolishly wasted. For a period of nearly one year there was a daily waste in the State of Indiana alone of more than 100,000,000 cubic feet. The daily loss to the people of Indiana on account of this enormous waste was more than $10,000. It is estimated that 30,000 cubic feet of gas in the Indiana field is equal to a ton of the best coal in stoves or furnaces. Coal delivered in the Indiana gas fields is worth $3.25 per ton. It is not an extravagant statement to assert that the cash value of natural gas wasted in Indiana since its discovery would be more than $20,000,000—an amount greater by far than the total capital invested in these fields on account of cheap fuel. The waste is still going on at the rate of 25,000,000 cubic feet daily. Hundreds of flambeaus, consuming on an average 2,000 cubic feet of gas per hour, have been allowed to burn day and night, without interruption, ever since the beginning of developments in the gas area. Hundreds of unprofitable wells are not plugged, but are left wide open and the gas allowed to escape into the air. This is especially true of the section of the field where petroleum is found in connection with gas. Scores of isolated wells that have been drilled for oil yield gas in large quantities, but they are not connected with pipe lines, and the oil is saved, but the gas permitted to waste. Reckless extravagance also prevails in the use of gas, both in factories and private houses. Gas, in the Indiana field, is not sold by measure, but it is supplied for factory or domestic purposes at a fixed price per month. It makes no difference whether much or little is consumed, the price is the same. It costs no more to continue the fires 24 hours in the day than it does 1 hour. With this state of things existing the consumer has no interest in practising economy. Fires are allowed to burn continually in unoccupied rooms and unused furnaces, without regard to the value of the fuel consumed. If gas were sold by measure for all purposes, consumers, especially, would practice economy. The statement may seem extravagant, but it is doubtless true that at least 40 per cent. of the gas consumed in the Indiana field, factories, dwellings, etc., is actually wasted.

But one result can follow this extravagance, and that is a quick exhaustion of the field. A final exhaustion is inevitable under any circumstances, but the profligacy that now prevails is destroying the field at a two-fold ratio. With economy in its use natural gas will bring capital and prosperity to the field for years to come, but the quick exhaustion that will surely follow the extreme prodigality of the past few years will necessarily result in the abandonment of the field, to a certain extent for manufacturing purposes.

Gas is most beneficial when consumed for domestic purposes. In this way it benefits a much larger proportion of the population, and there is also more profit to the producer in selling it for domestic use. As the volume of the supply gradually decreases, it will necessarily be withdrawn from use in the factories and the supply confined exclusively to domestic use.

It is well to note that at this time there is a united action on the part of the various companies producing natural gas throughout the various fields looking to its preservation and endeavoring to secure rigid economy in its use. If these efforts are successful, the period of prosperity now prevailing throughout the gas areas will be materially lengthened.

## Gas Burners—A Suggestion.

[A Paper read by Mr. THOMAS TRAVERS, before the Incorporated Gas Institute.]

Much has been said and written on the value of good burners, as compared with bad, in developing the illuminating power of gas. Yet the majority of gas consumers appear to be indifferent to the importance of the point, notwithstanding that it was for their advantage that so much attention has been given to the matter by gas engineers. This indifference on the part of consumers I attribute to the fact of their being in most cases improperly advised; and there are not wanting instances where they have allowed prejudice to interfere.

When an intended gas consumer requires his house fitted, the gas fitter will assist him in the selection of suitable gasaliers and brackets, as the case may be; and he will supply nicely decorated globes. But when it comes to the question of burners, as I stated in a former paper, I have never known a gasfitter who took any steps to ascertain the quality and the pressure of the gas. As a rule, they appear to be ignorant of the fact that in order to obtain the best results from burners it is essentially necessary that they should be adapted both to quality and pressure. Want of attention in this respect is the reason why we so often find that consumers are supplied with burners in what might be called a haphazard way; with results with which you are too familiar. I found ignorance of what constitutes a suitable burner to prevail in so called high quarters, as the following will illustrate:

In a certain Government department complaints were made, in language such as Government officials know how to use when they believe themselves the happy possessors of a grievance. This time "bad gas" was the war cry. So loud was their complaint that little short of being allowed to increase the quality of the gas by carbonizing every member of the Company (Chairman and Directors included) would form an acceptable sacrifice to the wrath of those offended deities. As usual, the gas manager was made the scapegoat; and he had to face the storm. A very brief examination was sufficient to reveal the true state of the case. Burners which were fixed about twenty years ago were up to this time doing duty; and the flame from them was such that the forked light of the early days of gas lighting would have been a vast improvement on it. The manager pointed out to the official who accompanied him that the defective burners were the cause of the bad light; and he offered to prove this by removing the old burners and fixing new ones instead—which (like Aladdin's lamp) would be supplied free of cost. The offer was not only refused, but the manager was court-martialed, so to say; for, two or three days afterwards, he had to appear before a colonel and some other officers and give his reasons for saying that burners which had been fixed in the department so many years ago by the War Office were unsuitable. He was allowed to put his reasons (in military parlance, "his defence") in writing. In his memorandum the manager showed that the burners, even when new, owing to their construction, did not give within 30 per cent. of the light obtainable from more improved burners; and that now that they were old, there was not 20 per cent. of the available light from them. The document had to go to headquarters; and after many days a communication was received that "honorably acquitted" him; and permission was given to exchange old burners for new. But one condition was laid down—namely, that the old burners should be carefully stored, in case a new Secretary of War might order them to be refixed.

We have also to contend with prejudice, which I have proved elsewhere to be groundless. But it is an old saying, that prejudices die hard; and we have often evidence of this fact. When, as in the above case, the burners are unsuitable and bad, yielding an inferior light, the gas manager suggests that a change in the burners would improve the light without increasing the consumption; and he accompanies the suggestion with an offer to supply the burners. The offer is declined for the reason that it is believed that it was only made for the purpose of increasing the gas consumption far and away out of proportion to any improvement that there may be in the light.

With the undisputed fact before us that, in average town, the waste occasioned by bad burners may be represented by a large amount of money every year; it is important to consumers that they should be supplied with the best appliances for the combustion of the gas, so as to minimize this waste. In justice to gas companies, I will say that they are more anxious to see this state of things improved than consumers will give them credit for. As the gas company's services would not be acceptable to many in altering the condition of affairs, and the gasfitter, so long as he sells his other goods, will not trouble himself much about such a small item as a burner—and yet it is often the fulcrum of the lever in gas lighting. How, then, is the consumer to be served so as to obtain the desired results? My suggestion is that a public officer should be available to test, when required, burners for consumers. There are daily placed in the hands of such officials, with good results, matters which are of minor importance when compared with the large interests at stake in the gas industry. It may be said: "There are already in the several districts public officers who test the quality of the gas and the correctness of the meters. What more is necessary? My answer is, "Even with the meter correct, and the gas of standard quality and often above it, the consumer, at the point of combustion, frequently does not get between 20 and 80 per cent. of the value of the gas; and thus he probably suffers a far greater loss than if his meter was not quite correct, or the gas not up to the standard." In fact, until control is extended in the way suggested, the other advantages that may be said to be gained by such services are in many instances neutralized. Place the consumer in the same position in reference to his burners as he is now with respect to his meter. For a small fee, he can at any time ascertain the correctness of the latter. Let a small fee—say per dozen burners—be fixed, on the payment of which the consumer can obtain the necessary information as to their suitability, etc.; and the meter tester or other official should be in the position to afford the fullest information on this point.

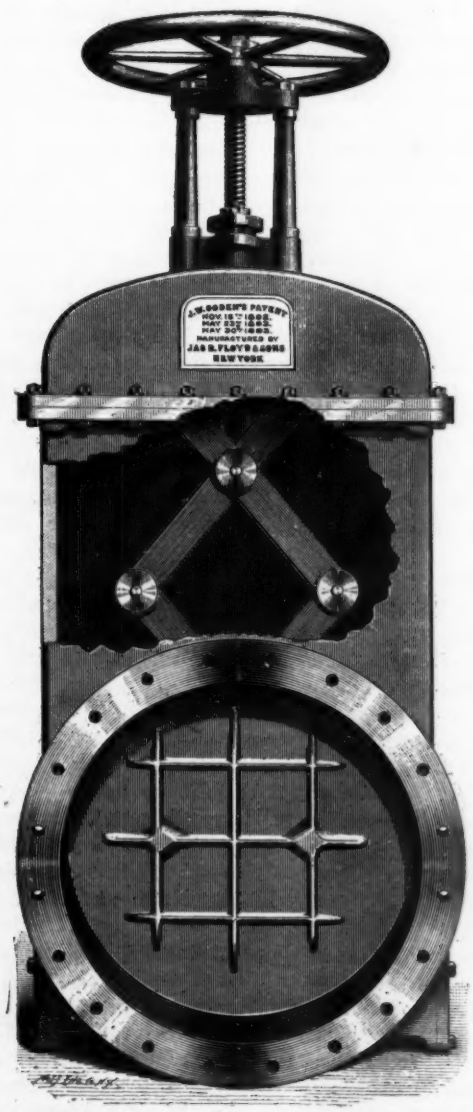
High-class burners, such as of regenerative type—which are made with much care and accurately tested—are not of the class to which I

refer; my remarks are intended for ordinary burners in general use, and which occasion so much waste of light-giving material. The fact that a public officer would be available for the testing of such burners would have the effect of making manufacturers enter into rivalry, and of stimulating them to greater skill in their production. Thus an all-round good would be done. The burner makers would be sure to obtain their reward when excellence is attained; gas consumers would derive the largest benefit; and gas companies would also be sharers. Last, and by no means least, the much-maligned and misrepresented gas manager would have the brilliancy of his production reflected on his character, revealing it to be always irreproachable.

### The Ogden Quick Moving Valve.

The accompanying cut affords a clear illustration of the mechanism of the Ogden quick moving valve, which is now being put on the market by Messrs. Jas. R. Floyd & Sons, of the Oregon Iron Works, 539 West 20th street, this city.

The main feature of the valve is the lazy tongs, operated by means of a double-threaded screw. These tongs multiply the distance traversed by the screw, and produce a very quick movement of the gates. Another idea may be seen in the novel construction of the hollow stem, which contains a thrust collar at the upper end, through which the screw enters, causing the stem to advance or recede as the screw is rotated. The screw at no time comes in contact with the gas or fluid passing through the valve, is not likely to become corroded, and may at any




time be lubricated without removing any of the parts. In closing the valve the lazy tongs project the gates rapidly until they are directly opposite their seats and rest on the stops. This brings into immediate action the locking device, which consists of two toggles, one at each end of a bar, which joins the lazy tongs, and which also carries the gates; when in this position a slight movement of the tongs will cause the toggles to spread and force the gates firmly to their seats. In opening the valve, the first action of the screw, through the medium of the lazy tongs, is to loosen the toggles and to draw the gates slightly together free from their faces; the gates being thus loosened, the lazy tongs move them very rapidly until a full opening is obtained. If desired, the bonnet or hood may be entirely removed, and the interior mechanism may be examined without unlocking the valve while in its closed position.

Valves on this principle, of 16, 20, 24 and 30 inches, are now in use and giving perfect satisfaction at the works of the Consolidated Gas Company, of New York, the Standard Gas Light Company, of New York, and the Bureau of Gas, Philadelphia, Pa.

### Decision Rendered by the Board of Gas and Electric Light Commissioners, Annulling the Municipal Permission Granting the Quinsigamond Electric Power and Light Company the Right to Operate a Plant at Worcester, Mass.

The State Gas and Electric Light Commission has just issued its decision revoking and annulling the permission granted by the Board of Mayor and Aldermen more than a year ago to the Quinsigamond Electric Power and Light Company to erect poles and run wires for the purpose of supplying electric lights to the city of Worcester, Mass. It will be remembered that the Aldermen granted this franchise against the opposition of the Worcester Electric Light Company. This Company took an appeal to the State Commission and the latter gave a hearing to both Companies. The decision has been delayed by the pressure of business before the Commission, and other causes, until now.

The Quinsigamond Electric Power and Light Company is a project of H. H. Bigelow, who organized a Company and proposed to turn into it his present electric plant. Its nominal capital of $10,000 had not been paid in. The idea as announced at the hearing before the Commission was to establish a plant at Lake Quinsigamond to compete with the Worcester Electric Light Company in supplying electric power and lights. The capital was to be increased as need arose, and several local capitalists had indicated their intention to go into the new enterprise.

The decision takes the ground that a competing Company is not desirable, because it would needlessly encumber the streets with wires, it would not furnish light or power more cheaply than the present Company, and there would be danger of consolidation or absorption with consequent "stock development" and an increased tax on consumers.

Commissioner Barker, in conversation with a reporter of the *Spy*, said the Worcester Electric Light Company was furnishing first class light and doing it as cheaply, both for the municipality and private consumers, as any Company in the State.

The Commissioners' decision, which gives a full history of the case and the reasons which have influenced them in annulling the franchise granted by the Aldermen, is as follows:

OFFICE OF THE BOARD OF GAS AND ELECTRIC LIGHT COMMISSIONERS,
BOSTON, June 30, 1893.

Upon the appeal from an order of the Board of Mayor and Aldermen of the city of Worcester, granting permission to the Quinsigamond Electric Power and Light Company, to erect poles and run wires for the purpose of supplying electric light within the limits of said city.

As required by the statutes, a public hearing was given upon the appeal, and sessions of the Board for that purpose were held in the city of Worcester. The Quinsigamond Electric Power and Light Company and the Worcester Electric Light Company were represented by counsel, but neither the city nor any other parties were represented either to favor or oppose the appeal.

The Quinsigamond Electric Power and Light Company was organized on the 25th day of January, 1892, by three well known citizens of Worcester, with a proposed capital of $10,000. No portion of the capital has yet been paid in, but it is understood that if this appeal should be dismissed a plant which for some years has been used to supply electric power, and is owned by the same parties, will be transferred to the new corporation in lieu of a cash payment for stock. It appeared at the hearing that it was the purpose of the promoters of the enterprise to establish a plant upon the extreme eastern boundary of the city and about two miles from its center, on the shore of Lake Quinsigamond, and from that point to supply lights throughout the city.

Since the year 1883 the city has been supplied with electric lights by the Worcester Electric Light Company. This corporation has established its station within a short distance of the principal mercantile and manufacturing section, and upon the shores of a pond of about 5 acres in extent. Its plant, which has been recently constructed, includes compound condensing engines of about 1,600 horse power, and dynamos capable of supplying 820 high candle power arc lights and about 4,000 incandescents. It is actually supplying 675 arc lights and 4,153 incandescents, and has about 135 miles of wire and 2,200 poles in the public streets.

This appeal is made pursuant to the provisions of chapter 382 of the Acts of 1887, which requires the Board to hear all parties interested, and that its decision shall be final. From this it would seem to be the duty, as it has been the practice of the Board, to make such an appeal the subject of careful inquiry, as if it were a new case not previously heard elsewhere. This seems to have been expected by the Aldermen, as from their records it would appear that but little time was given to the consideration of the application. It seems to have been understood that, whatever their action, an appeal would be taken, and their action indicates that they believed the public interest demanded that their time and attention should be given to other pressing and perplexing questions whose final settlement was wholly within their jurisdiction rather than to this.

The parties interested in an application of this character are the general public, the consumers, and those who have invested or desire to invest their money. The number of companies which can conveniently engage in this business must be necessarily limited, owing to the nature of the work and the fact that its conduct involves an extensive use of the public streets for the poles and wires. These lines must necessarily be charged with dangerous currents of high intensity, and in combination with wires for other purposes, are a constant menace to life and property wherever they exist. While above the highway, they may offer serious obstruction to a successful contest with fires; and if underground they become, through the necessity for frequent opening of the streets, a fruitful source of interference with travel. The sections where the greatest volume of trade and travel exist are sought first by all companies as the most profitable field for the business, with the result that wires become most numerous where they are the most likely to be troublesome and dangerous. Attempts to regulate or control the construction of these lines by official supervision have met with only limited success. There is a general public demand that such a use of the streets should be restricted, that the number of these wires should be kept at the minimum needed to properly supply the public needs, and that they should be multiplied only when some substantial advantage is to be acquired or the public convenience to be served thereby. For these reasons some probability should exist of either a saving of cost or an improvement of service to justify encumbering the streets with the poles and wires of another company.

In many respects the case under consideration differs from any which the Board has previously been called upon to consider.

At the hearings but few witnesses were introduced and but little evidence presented. The persons interested in the enterprise are respected residents of the city and are entitled to the most careful consideration. The capital mentioned in the charter is obviously too small to effect the purposes of the corporation, but it is assumed that it may be increased to any needed amount.

Some of the witnesses expressed the opinion that the city afforded a fair field for two companies, but no facts or arguments were submitted in support of this view. It did not appear that these persons had given the question much consideration or had any particular knowledge of the business itself. They probably intended to express their individual belief that there was sufficient undeveloped business to support a second company with a fair profit or that it would receive public support because it could give the consumers some advantages not now within their reach.

This comes very near assuming the whole case, and it would seem that those who take this view should be prepared to submit some facts or arguments upon which the opinion may be based, but none were attempted. The specific testimony presented at the hearing and the facts in the possession of the Board seem to oppose this view rather than to favor it.

There was no claim nor pretence made by the representatives of the new company that they would be able to supply lights for any less price or of any better quality than those of the existing Company, or that in any particular respect the service would be improved. It did not appear that the present Company had unreasonably failed or refused to supply any lights for which request had been made. The Company, indeed, expressed its willingness and demonstrated its ability to supply both arc and incandescent lights to any extent that might be desired, wherever the nature of the business would permit and at reasonable rates. No criticism of its prices or its service was offered. In the year 1890, in refusing to allow the consolidation of this Company with the Worcester Gas Company, the Board referred to its plant and policy in the following terms:

"Every advantage in construction known to the best engineering skill seems to have been employed, and all its appliances rank with the best. It has just completed and equipped with a plant a building of ample size for all probable needs of the city for some years to come. Its affairs have been managed with strict economy. Its policy has been conservative and free from speculative features."

The evidence as presented to the Board seems to afford no reasonable ground for the expectation that the proposed Company could afford its lights for less than the existing Company. The location suggested would doubtless enable it to manufacture the electricity at as low cost, but its greater distance from the center of consumption would increase the cost of distribution. It does not possess and probably does not expect to acquire the exclusive control of any invention by which special saving in cost may be effected, and it cannot reasonably be expected to possess any higher technical or business talent than lies within the reach of the existing Company.

It is the duty of the Board and its only purpose to secure to the people of Worcester, so far as lies within its power, the best service at the lowest reasonable price. There is some reason to believe that the admission of proposed Company might seriously impede, perhaps wholly defeat this object. It must be recognized that both Companies are to be promoted and to be conducted for the sake of profit, and that they will be governed by the same laws as other companies in similar business. The capital account of the existing Company is low, and the amount required for a fair dividend is less than in most companies of its size and character. It is important to the consumers that this condition should be maintained, as no single item contributes more to the cost of lights than a proper charge for dividends. The present Company can add 10,000 or 20,000 lights to its present output, with a much smaller investment of new capital than could possibly be done by a new Company. The history of corporations doing an electric lighting and similar business in competition in various parts of the country affords strong ground for believing that a new Company, if allowed to engage in business, would not long remain by itself, as competition for a period would probably be followed, as elsewhere, by consolidation or absorption. Whether or not such union would be for the public good, the Companies would see a gain thereby, and no power rests in this Board or elsewhere under existing laws, which could effectually prevent some form of consolidation. If the advantages incident to the growth of population and the development of business are to be secured and retained for the benefit of consumers, every reasonable effort must be made to prevent unnecessary development of the capital chargeable upon the business. But combinations and consolidations, as is well known, afford the opportunity and usually a temptation to stock development too great to be resisted. Such needless outlay should be avoided and saved, for when it has once been incurred or the money expended in an enterprise not required to supply the public wants, so great is the expectation of gain, and so persistent and unyielding the demands of capital for dividends, the remedy is not then easily found or applied, and the better policy avoids the evil at the outset by preventing the expenditure.

It may properly be noted that in the early history of electric lighting in this city an illustration was afforded of the results of an attempt by two interests to supply the light. The principal promoter of the new Company was then engaged in the supply of electric light upon a small scale, and the business itself was new. Very soon after the advent of the existing Company, he found it for his interest to enter into an arrangement with them. For a portion of his plant and the good-will of his business, and an agreement not again to enter it for a term of years, he received the sum of twenty thousand dollars, by far the greater portion of which was not for the plant. Every dollar of this amount the consumers of electric light in Worcester have been compelled to refund in the shape of higher charges for their lights. Is it desirable or wise that this course shall be repeated, with a much larger amount involved?

The principal promoters of the new Company are the owners of a large tract of land upon the shores of Lake Quinsigamond and of another tract midway between the lake and center of the city, well adapted and partly occupied for manufacturing purposes. In the sections of the city where these tracts are located there is probably little or no other demand for electric lights. Situated upon the lake shore are numerous private residences and pleasure grounds which attract great numbers of of people during the Summer months. There is some demand there for lights for about three months in the year, and although this service is special in its character and perhaps unprofitable, it appeared that all the lights requested had been supplied there and at regular rates. In either of these locations if sufficient lights were desired it is not unlikely that some advantage could be gained by the construction of separate plants to supply them. Such a plant already exists in one of them. As they could probably be constructed and maintained in either place without crossing the highway, the permission of the Mayor and Aldermen for

them would not be necessary, and they would not be affected by the decision in this case.

No request was made for a franchise limited or restricted in any way. It was particularly stated that such was not desired and would not be accepted. The grant from the Aldermen contains no restrictions or limitations whatever. No authority exists in this Board to modify or in any way restrict the order upon which the appeal is based, but the appeal must be sustained or dismissed and the order affirmed or annulled without qualification.

If to sustain this appeal shall seem to secure to the existing Company a monopoly of the business, it must be remembered that it can only retain this as long as the public interest is best served thereby, and that such monopoly is conditional and restricted. The Company claims and exercises a general franchise throughout the city. It may be compelled to meet all reasonable demands. If it unreasonably fails or neglects to supply light when requested, this Board has power to compel such supply, and has frequently exercised this authority in other localities. Consumers have a right to the lowest remunerative rates, and if they believe the prices charged are too high they can petition for a reduction, and the order of the Board as to price is binding upon the Company. While the interests of the shareholders, present or prospective, ought not to be overlooked, the convenience, comfort and pecuniary benefit to the community are surely of the first importance.

For the reasons suggested, the Board deems it unwise to grant the Quinsigamond Electric Power and Light Company the prayer of its petition. It is therefore ordered that the appeal be sustained and that the permission of the Aldermen be revoked and annulled.

For the Board, FORREST E. BARKER, Commissioner.

## Smokeless Combustion of Coal in Europe.

Recent reports from Germany convey the idea that the difficulty of burning coal without the production of smoke has been overcome, and that the demonstrations leading to this result have excited much interest among several large enterprises, including the North German Lloyd and the Hamburg-American Packet Company, while, it is said, the Vulcan Forges of Stettin have actually adopted the new system. This invention differs from all others which have been employed for the pur pose up to the present time, and it is styled "the automatic and smokeless combustion of powdered coal."

The process is a simple one, says *Invention*. The fuel, instead of being introduced into the fire-box in the ordinary manner, is first reduced to a powder by pulverizers of any construction. In the place of the ordinary boiler fire-box, there is a combustion chamber in the form of a closed furnace, lined with firebrick, and provided with an injector similar in construction to those used in oil-burning furnaces. This chamber has two openings—one on the center line and in the place of the usual furnace fire door, the other on the opposite side. The orifice of the nozzle is placed in the latter aperture and throws a constant stream of fuel in the chamber. This nozzle is so located that it scatters the powder throughout the whole space of the fire-box. When the powder is once ignited—and it is very readily done by first raising the lining to a high temperature by an open fire—the combustion continues in an intense and regular manner under the action of the current of air which carries it in. This current is regulated once for all by the amount of powder required for the production of the heat led off to the boiler and the evaporation of the weight of steam demanded.

The powder is stored in a box, whence, by means of an ingenious arrangement, the air under pressure carries it to the fire-box. Numerous applications and experience have, according to Continental journals, established this practice on the Southeastern Railway of Russia and the steam vessels of the Caspian sea.

In the system under consideration, the coal, so that it may be drawn out and carried along the steam or air under pressure, needs to be finely pulverized, and that is why it is explained that success has been attained in the use of coal which was already finely divided.

The air and fuel are, therefore, intimately mingled in the furnace. It is urged that in this process the combustion of the fuel is complete, for each particle of coal in suspension in the fire box is in contact with the oxygen required for its consumption, which is thus proved to be a state of affairs far less difficult of attainment than was hitherto considered.

It is also explained that the air entering the combustion chamber may be first heated to a high temperature by utilizing the heat of the escaping gases in the stack. This air may also be mingled with a jet of steam, which decomposes into hydrogen and oxygen, the hydrogen serving by its combustion to assist in the elevation of the fire box temperatures. By this system the admission of cold air is avoided and a constant temperature can be obtained. It appears that in case of accident the fire can be instantly extinguished by actuating the valve, which cuts off the supply of fuel. High chimneys are no longer a necessity, as the fire box is operated under a sort of forced draught.

If we can accept the reports issued describing the results obtained, the system must be a valuable discovery. Works situated in the centers of densely populated localities will find obvious advantages in its use. Even if it be less economical than claimed, the very fact of its suppression of smoke should lead to its wide adoption.

## ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE proprietors of the Gettysburg (Pa.) Gas Company have declared a dividend of 3 per cent. out of the earnings for the last six months.

AT the annual meeting of the Burlington (Vt.) Gas Light Company the following Directors were chosen: B. B. Smalley, F. H. Wells, A. G. Pierce, U. A. Woodbury, J. S. Pierson, R. G. Severson and A. H. Parker.

IN the suit of the Davenport (Iowa) Gas Company against the Dubuque Construction Company, which was brought by plaintiff to recover damages to its gas mains caused by defendant's method of constructing a system of sewers on city account, a verdict for defendant was rendered by Justice Wolf. The Justice holds that the city has the right to construct all necessary sewers as long as ordinary care (which he maintains was shown in the case in point) in their construction is observed, the rights of the Gas Company being secondary to those of the city.

JUDGE WALTER LLOYD SMITH has appointed Mr. Rueben Leland Receiver of the properties of the Elmira (N. Y.) Gas and Illuminating Company and the Elmira Illuminating Company. The appointment was made with the consent of the larger creditors of the two Companies, and was done in view of the possible judgments which may be secured against the Companies.

AT the annual meeting of the Milwaukee (Wis.) Gas Light Company the transfer of the gas plant to its new owners was formally ratified, and the following officers were chosen: Directors, Emerson McMillin, F. W. Montgomery, Benjamin M. Weil, A. E. Smith, J. P. Murphy, E. G. Cowdery, S. M. Green, H. C. Payne and B. K. Miller; President, Emerson McMillin; First Vice President, F. W. Montgomery; Second Vice-President, Benjamin M. Weil; Secretary, A. E. Smith; Treasurer, J. P. Murphy; General Manager, E. G. Cowdery.

THE following is a synopsis of the changes in the management of the Richmond (Ind.) Gas Light Company consequent upon the sale of a controlling interest in the same to a syndicate. The corporate title is to be that of the Richmond Light, Heat and Power Company, and the capital stock is put at $300,000. The Directors are James M. Starr, J. W. Roney, J. D. Platt, J. C. Reber, Valentine Winters, H. C. Kiefaber, O. E. Stuart, A. W. Kumler and J. E. Lowes; President, J. E. Lowes; Vice-President, J. M. Starr; Secretary and Manager, J. W. Roney. The President states that the Company will expend something like $100,000 on plant extensions, the major portion of which will be disbursed in improving the electric section of the Company's possessions.

MR. B. MCADAM, of Port Townsend, Wash., has been appointed Superintendent of the Michigan City (Ind.) Gas Company, vice Mr. B. A. Ward. Mr. Ward, who has engaged in the business of plumbing and gas fitting, is now carrying out a contract recently awarded him for the plumbing and heating apparatus on the new court house at La Porte, Ind.

THE Berlin Iron Bridge Company, of East Berlin, Conn., has received from E. D. Leavitt, consulting engineer of the Calumet and Hecla Mining Company, a contract for the iron roof over its new engine house. The building will be 80 feet wide and 200 feet long.

RESIDENTS of the Hyde Park district of Chicago, who are supplied with current for incandescent lamps from the wires of the Hyde Park Thomson-Houston Electric Light Company, have recently been notified to the following effect: "On looking over our records we notice that your bills for electric lighting have been so small that it represents a loss to us. Our investment for transformer, meter and connections is so large that unless we receive a minimum of two dollars ($2) per month we will be obliged to discontinue the service. Beginning —— —— no

monthly bill for less than $2 net will be rendered. The demand for lights is greater than we can supply, and although we do not wish to lose an old customer, if our lights are not valued to the above extent by you we will be compelled to put them where they are better appreciated." The ordinance under which the Company operates specifies, amongst other things, that consumers shall be charged not to exceed 1 cent per hour.

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GOVERNOR RUSSELL has appointed Gen. Morris Schaff, of Pittsfield, to succeed Mr. Charles A. Towne, of Orange, on the Massachusetts Board of Gas and Electric Light Commissioners. It is conceded on all sides that the appointment is an excellent one.

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WE are indebted to a correspondent at Columbus, Ga., for the following timely hints: "The stockholders of the Gas Light Company of Columbus, Ga., held their annual meeting a few days ago and elected the following officers: President, T. E. Blanchard; Secretary and Treasurer, T. D. Huff; Superintendent, E. H. Jenkins; Directors, T. E. Blanchard, J. B. Holst, D. F. Wilcox, W. L. Clark and T. D. Huff. The usual three per cent. semi-annual dividend was declared, and the usual allotment to the sinking fund was made. After paying taxes, interest and all other charges and debts, the Company has some money left. Another important step taken was in the promulgation of a new rate schedule, the arrangement of which is as follows:

| Monthly Consumption. | Net Rate per 1,000. |
|---|---|
| 5,000 cubic feet | $1.75 |
| 5,000 " and less than 10,000 | 1.50 |
| 10,000 " and over | 1.25 |
| Fuel Gas, any quantity | 1.25 |

These are very cheap rates for the gas, all things considered, in a place like Columbus, Ga., but the proprietors of the Company are shrewd business men, and are evidently in the race to stay. About the best pleased man in the Company to-day is Superintendent Jenkins, the President-elect of the Western Gas Association, who was always a pronounced advocate of the policy of selling gas at the lowest figure possible."

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A CORRESPONDENT at Laconia, N. H., sends the following: "The annual meeting of the Laconia Gas Light Company was held at 4 P.M. of the 5th inst., in the rooms of the Laconia National Bank. The officers chosen were: President, John C. Moulton; Treasurer and Superintendent, John O. Laughlin; Clerk, C. W. Tyler; Directors, John C. Moulton, Frank C. Buzzell and Henry S. Jackson. There has been an infusion of new blood in the Company, Boston capitalists having become interested in its management. A new plant, to be constructed at once, is to be located on Meser street, near the bridge, on land purchased from C. Ladd. The buildings will be of brick, and the cost of the plant complete is put at $75,000. In place of the naphtha gas hitherto sent out, water gas will be manufactured, and this radical change cannot fail to please a large majority of the citizens. It will result not only in better service to the patrons, but in the removal of the disagreeable features connected with the plant as now situated on Main street, in the heart of the business portion. The smell from the refuse has been very offensive, and the danger from fire was another pronounced objection.

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THE Boston (Mass.) *Transcript*, for July 7th, remarks: "For the past few weeks little has been heard by the public in relation to gas matters in this city, and some may have imagined that nothing was being done by either of the two great gas corporations which have been so prominently before the people during the past six months; yet such an assumption would hardly be correct in regard to the Brookline Gas Light Company, which made its contract with the city of Boston, on February 28th, of the present year, and was to begin laying its new pipes as soon after March 10th as the frost was out of the ground. During the past five months, the Brookline Company has been aggressively at work in the streets of Boston. Under its contract it was to supply a certain part of the city with gas for all its public purposes for 70 cents a thousand cubic feet, and to private consumers $1.00 per thousand. By July 1st, of the present year, it was to be ready to supply the territory included in Wards 11, 16, 17 and 18—that is, the Back Bay and the South End districts. The other wards included in its contract, namely, 19, 20, 21 and 22 in Roxbury, it was to be ready for by September 1st. Inasmuch as July 1st has arrived and the opponents of the Brookline Company have claimed that it had no right to lay pipes in this new territory, and that the whole contract itself was illegal and void, inquiry was made at the office of the Brookline Gas Light Company to find out the exact state of affairs. The President of the Company, Dr. Robert Amory, said: 'We have never been disheartened by the threats of other people, because we have felt perfectly secure in our legal position, and did not believe the public would allow any illegal interference with a contract so advantageous to the city of Boston and to the public at large. As soon as the frost was out of the ground, on March 16th, we began our work, and have prosecuted it ever since with increasing force each week. We have several hundred men at work, and have piped almost the entire territory we were to cover by July 1st. We were to lay, by that time, 36 miles of pipe, and we have actually laid nearly 30. We have piped the whole of the Back Bay district and almost all of the South End, besides some streets in Roxbury. We were somewhat delayed at first it getting a sufficient quantity of pipe, but five foundries have been at work turning out pipe for us, and we no longer have any difficulty. We have also been delayed by the fact that a number of the streets are paved with asphalt, and upon these we are to lay our pipes under the sidewalks in the Summer months, when it will least disturb the public. Upon July 1st, we began connecting with the public lamps, and are now connecting a large number each day. In ad ditioton this, we are daily connecting our pipes for private consumers."

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WE learn that the Hazelton Boiler Company, of this city, is erecting one of its 150 horse power boilers at the works of the North Adams (Mass.) Gas and Electric Company, which will make the second boiler of that size said Company has placed in its well-conducted establishment. Most flattering accounts of this boiler come to us from various gas companies throughout the country, prominent among which are the Consolidated Gas Company, of New York; the Mutual, of New York; the Nassau and Metropolitan Companies, of Brooklyn, N. Y.; also, the Companies at Boston, Mass., Milwaukee, Wis., and St. Paul, Minn. We are also informed that the Hazelton Boiler Company is completing duplicate orders for large boilers for several prominent concerns outside of the gas industry, all of which indicates that this excellent steam raising apparatus is constantly growing in popularity wherever it is in use. Sooner or later this boiler will command the market, for it possesses novel and valuable features which must interest those who investigate its construction and operation.

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ALDERMEN Beck, Buprer, Roser and Roth, of the Committee on Streets and Ordinances, of Detroit City Councils, recently reported a modified form of ordinance for the government of the local Gas Company, that differs considerably from the one originally proposed by Mayor Pingree. Under the Pingree ordinance the Company was granted a 10 year franchise, which term the Committee proposes to extend to 15 years. The price for gas as the Mayor fixed it was 90 cents per 1,000, with 10 cents off for prompt payment, and the Committee recommends that the Company be permitted to charge $1.10 per 1,000, with 10 cents off on all bills settled within 30 days. This price is to hold until the Company sells more than 300,000,000 cubic feet of gas in one year. When it produces more than that and less than 400,000,000, the price is to be reduced to $1, with 10 cents off. When the amount produced is more than 400,000,000, the price is to be reduced to 90 cents, with 10 cents off if paid within 30 days. The inspector who will have supervision of the business of the Company on behalf of the city is to be appointed by the Public Lighting Commission. This agreement, which looks to be an eminently fair one, it is claimed will not be acceptable to Mayor Pingree, who really seems to be determined to wreck the Company's business rather than to regulate it. In the meantime the Council is considering the amended ordinance, and the chances are that it will receive the sanction of that body.

---

EDWIN EINSTEIN, of this city, has instituted an action against the Rochester (N. Y.) Gas and Electric Company to issue to him 4,800 shares of its paid up capital stock, or, in default thereof, to recover from the two defendants the value of such stock in money, which he places at $480,000, with interest from August 4, 1892. The following synopsis of the points involved will be of interest: "Charles M. Rowley, on March 4, 1891, acquired from the Brush Electric Company, of Cleveland, Ohio, owners of the Brush patents, the rights for Munroe county, N. Y. On May 19, 1891, Rowley made a contract with James M. Whitney and George E. Mumford, of Rochester, by virtue of which the defendant, the Brush Electric Light Company, was organized. On June 8, 1881, Rowley entered into a contract with the Brush Electric Light Company, by which Rowley and the plaintiff gave the Company the Brush patent rights for the city of Rochester, and the Company contracted to give Rowley 48 per cent. of its capital stock, then $100,000. The contract further provided, so the plaintiff alleges, 'that if at any time thereafter the said capital stock of the said corporation shall be increased, otherwise than for stock issued for cash paid therefor at the

time of such issue at par to the extent of $100,000 in addition to the present capital, 48 per centum of the par value of such increase shall be issued and delivered to the said party of the first part or his assigns, fully paid up.' On June 13, 1881, Rowley assigned all his rights in the premises to the plaintiff. The complaint states at considerable length facts to show that Einstein had acquired all Rowley's interest under this contract, and was recognized as having so acquired it by the Brush Electric Light Company, of Rochester. Among these are set forth the Company's issue to plaintiff of $480,000 of its capital stock, pursuant to the contract and its application to him for leave to increase its capital stock by $150,000 without paying him any portion of the increase, the granting of such permission by him, and the increase of the Company's capital stock under such permission."

THE Bay State Gas Company, of Boston, filed on July 7th in the Supreme Judicial Court, a petitition asking for the appointment of three Commissioners to determine the value of the property of the Company, as provided for by the Lyford bill passed at the last session of the Legislature. The petition sets out the material of the Lyford bill, and has attached to the papers a copy of the famous $4,500,000 note, the retirement of which is required by the bill. Judge Barker issued an order of notice returnable July 25th.

A QUARTERLY dividend of 2 per cent. on the shares has been ordered by the Directors of the Citizens Gas Company, of Brooklyn, N. Y. It is payable on and after August 2.

THE Gas and Electric Company, of Hillsboro, Ohio, has petitioned for a dissolution of partnership, pending which it asked the appointment of a receiver to take charge of the business. Judge Newby appointed J. M. Hughey receiver. The Company has been operated at a loss for some time, but was carried by the now closed Citizens Bank. The liabilities of the Company approximate to $36,000, and the assets are said to be about $24,000.

WE are indebted to a correspondent at Bethlehem, Pa., for the following from the local *Times:* "Improvements that will cost $25,000 or more are well underway by the Bethlehem Gas Company. The gas manufacturing apparatus is being duplicated throughout and the largest gasholder in the Lehigh Valley is at present in course of construction. The improvements are notable ones, in that Bethlehem will by the early part of September have a gas plant almost the equal of the finest in the State. The new gasholder is of the double-lift type, and will rest in an overground steel tank. Its diameter is 80 feet, and the sections are 30 feet deep. The holder is being erected by contract work and the builders are the National Iron Works, of Linwood, Delaware county, Pa. The work is being pushed with all possible dispatch so as to have it completed by September 1st. The increase in the consumption of gas in Bethlehem during late years has prompted the improvements. An official of the Company recently said: 'The permanent improvements now in progress here will give us a plant second only to the finest in the land. With all the apparatus duplicated, and the new large holder, there can be no danger of a shortage of gas in case of an accident at the works. The supply of gas can practically never give out.' The Company is to be commended on its push and energy. There are living to-day in Bethlehem scores of old residents who remember well when gas was carted to town in large bags, on wagons, from Allentown, and sold to Rufus Grider, Ambrose Rauch, Henry Oerter and other merchants of those old times, who had the spirit of progress in their hearts and minds. A half century later and Bethlehem has the largest and finest gas plant in the valley. Consumers of gas need have no fear that the price of that commodity will be increased on account of the improvements that are in progress. An official of the Company said: 'The thought of reducing the price is the one uppermost in the Company's mind. Let me tell you, if the people who burn the dangerous coal oil would become consumers of gas in Bethlehem and South Bethlehem, with our increased facilities we could furnish the finest kind of gas and at a price much cheaper than at present. The charges for gas to-day here are cheaper than anywhere else where the number of consumers is the same. We will use every effort to increase our subscribers, and then you may expect a cut in rates.'"

A JUDGMENT for $2,200 has been filed in the office of the County Clerk against the Elmira (N.Y.) Gas and Illuminating Company, in favor of W. H. Peters & Co.

THE contract for the public lighting by electricity of the city of Worcester, Mass., has been signed and is now in force. The contractor (the Worcester Electric Light Company) agrees to furnish 2,000 candle power arcs at 35 cents per arc per night, and the contract is to last for three years from July 1, 1893.

EARLY this month the Little Falls (Minn.) Gas Company filed a deed of assignment. Mr. C. W. Brown, the assignee, stated that the Company owed $5,000, whereas its rights and property were worth $25,000.

ABOUT 300 laborers in the employ of the syndicate that controls the gas supply and the street railroad systems of Indianapolis, Ind., recently went on strike. The bone of contention was higher wages for the railroad employees. The gas workers were satisfied with the wages paid them, but they joined the "outs" from "sympathetic" motives.

THE proprietors of the New Bedford (Mass.) Gas and Edison Light Company have declared a dividend of $1.50 per share, payable since Saturday last.

THE Cumberland Glass Works, Bridgeton, N. J., is installing a fuel gas plant on its works, the process being of the type known as the M.V. Smith process.

A CERTIFICATE of incorporation has been issued to the West Virginia Fuel Gas Company, of Charleston, West Va. The incorporators are B. H. Oxley, Moses W. Donnelly, R. T. Herdon, O. H. Michaelson and F. R. Stewart.

FROM the report of Mr. W. K. Park, Chief of the Bureau of Gas, Phila., Pa., to Mayor Stuart, detailing the operations of the Bureau for the year ended December 31, 1892, we find that the "Improvements and extensions for 1893 comprise two new stacks of the D. D. Flemming benches, which will give a daily manufacturing capacity of beyond 7 millions cubic feet at the Point Breeze works; a set of four purifying boxes, a condenser and a scrubber, two station meters and a new meter house at the same works; 20-inch mains on Mifflin street, from 16th to 22d streets, and on Lehigh avenue, from 22d street to Ridge avenue; 12 inch mains on Oxford street, from 27th to 33d streets, and on 22d street, from Dickinson to Mifflin streets; 8 inch mains on 52d street, from Lancaster to Elm avenues, and on Frankford avenue, from Orthodox to Bridge streets; 6-inch main on Tacony street, from Frankford avenue to Duncan street, and a continuance of the policy of replacing with 6-inch pipe the 4-inch and smaller pipe now inadequate to the demand. I had anticipated at least beginning the laying of a main from the Twenty-fifth Ward Works for the relief of the consumers in the Eastern portion of the upper end of the Twenty-second Ward, but delay has again been occasioned by reason of some of the streets selected not having been opened. To this would be added, if there were sufficient money, the substitution of a new shell for one of the holders at the Twenty-fifth and Callowhill streets station, now, by reason of age, practically useless."

## The Deterioration of Incandescent Lamp Bulbs

The deterioration of incandescent lamps has often been laid to the bombardment of gas molecules, but Prof. Thomson has long been convinced that in a well exhausted lamp it is due almost entirely to evaporation by high temperature. Just as ice evaporates in vacuo, so carbon acquires in vacuo a certain volatility at an increasing rate of the temperature. He assumes, of course, that the vacuum is so good that none of the bluing or visible discharge of current takes place, which of course wears the filament by actual carriage of carbon. He thinks that it would be very strange if carbon maintained at so high a temperature in a vacuum did not evaporate at all, as it is well known that almost all substances raised to a sufficiently high temperature do give off insensible vapors, and that melted metals frequently behave as mercury does at the ordinary temperature; the presence of foreign substances and gases will in some instances accelerate the action or perhaps in other cases retard it. In a lamp a certain evaporation takes place which is independent of the size of the bulb, from which it follows that the age coating will become much less as the bulb is greater in size, for the same deposit will yield a much thinner coating of carbon over a large surface than over a small one. If one lamp were made with the smallest possible bulb and another with a large bulb, the former might be rendered opaque, while the latter would only be slightly darkened, other conditions being the same. He puts great stress on the uniformity of the filament, and gives the reasons. It appears to be true, he says, that the limit of practical improvement in the efficiency of incandescent lamps is to be found in the properties of the element carbon, and particularly its volatility. It is fairly safe to say that no other less volatile substance has yet been found, and that carbon, as pure and perfect in structure as possible, is likely to hold its place, at least for some time to come, as the material for incandescent lamp filaments.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,

PROPRIETORS.

MONDAY, JULY 17, 1893.

## The Market for Gas Securities.

This week witnessed another slump in the general share market and gas stocks suffered with the rest. Consolidated opened to-day (Friday) at 120 to 120¼. The sales yesterday amounted to 910 shares, at 120 to 119¾. A somewhat better feeling prevails to-day, and we can only repeat our advice of the past three months that Consolidated is a purchase. Other city shares are about as before, but the inquiries for purchase account are few and far between. The Brooklyn situation remains unchanged, either as to the proposed consolidation or to market quotations, which are of the most perfunctory type. Chicago gas, which broke to 59 and a fraction on Tuesday last, recovered some of the decline, and opened to-day at 63⅜ to 63¼. Bay State is weaker, at 13 to 14½, but there should shortly be a rally in these shares. The Company has applied for a commission to value the works, in accordance with the terms of the Lyford bill, which means, of course, the cancelling of the famous $4,500,000 note. Baltimore Consolidated is dull, at 54¼ to 54⅝. Laclede common is below 16, and the preferred is offered at 60.

## Gas Stocks.

**Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,**

16 Wall St., New York City.

July 17.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

| | Capital. | Par. | Bid | Asked |
|---|---|---|---|---|
| Consolidated | $35,430,000 | 100 | 121 | 121⅛ |
| Central | 500,000 | 50 | 90 | 95 |
| " Scrip | 220,000 | — | — | 100 |
| Equitable | 4,000,000 | 100 | 170 | 175 |
| " Bonds | 1,000,000 | — | 106 | 108 |
| Harlem, Bonds | 170,000 | — | — | — |
| Metropolitan, Bonds | 658,000 | — | 110 | 115 |
| Mutual | 3,500,000 | 100 | 139 | 142 |
| " Bonds | 1,500,000 | — | 100 | 102 |
| Municipal, Bonds | 750,000 | | — | — |
| Northern | | 50 | — | — |
| " Bonds | 150,000 | — | — | 100 |
| Richmond Co., S. I. | 346,000 | 50 | — | — |
| " Bonds | 20,000 | — | — | — |
| Standard Gas Co— | | | | |
| Common Stock | 5,000,000 | 100 | 35 | 40 |
| Preferred | 5,000,000 | 100 | 80 | 85 |
| Yonkers | | 50 | 112 | — |
| Gas Co's of Brooklyn. | | | | |
| Brooklyn | 2,000,000 | 25 | — | 113 |
| Citizens | 1,200,000 | 20 | 100 | 101 |
| " S. F. Bonds | 320,000 | 1000 | — | 103 |
| Equity Gas Light Co | 2,000,000 | 100 | — | — |
| Bonds | 1,000,000 | — | — | 60 |
| Fulton Municipal | 3,000,000 | 100 | 125 | — |
| " Bonds | 300,000 | | 102 | — |
| Peoples | 1,000,000 | 10 | — | 92 |
| " Bonds (7's) | 368,000 | — | 100 | — |
| " " (6's) | 94,000 | — | 100 | — |
| Metropolitan | 870,000 | 100 | — | 123 |
| " Bonds (5's) | 70,000 | — | 100 | — |
| Nassau | 1,000,000 | 25 | 150 | — |
| " Ctfs | 700,000 | 1000 | 99 | 100 |
| Williamsburgh | 1,000,000 | 50 | 130 | — |
| " Bonds | 1,000,000 | — | 107 | 110 |

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This Generator takes but little room. It requires no change to be made in the height or depth of gas houses. It is more easily repaired when necessary. It is simpler and easier operated. It makes *more good gas from a given quantity of stock.* It makes good gas from *cheaper stock.* It makes gas of *any desired candle power* up to thirty without smoke. It makes a faultless gas from whatever gas producing materials are cheapest in the locality where required, using hard coal or coke in connection with Lima crude or any other crude petroleum or its distillates, including *Naphtha of any specific gravity.* I build these Generators with any required capacity from 3,000 cubic feet per hour upward.

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Correspondence solicited.

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Single and Multiple Section Gas Holders a Specialty.
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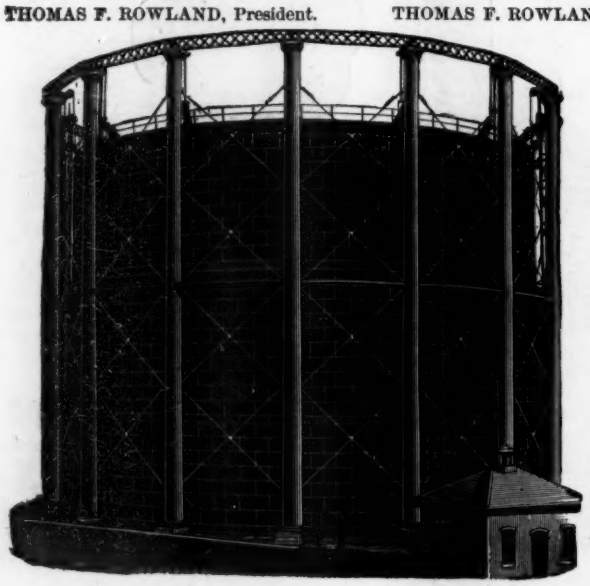

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. . . . Different . .
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RANGING IN PRICE FROM $3.00 to $63.00.

New . . . . . .
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The SCHNEIDER & TRENKAMP CO.,
Sole Manufacturers of Reliable Gas Ranges. 479-501 Case Ave., Cleveland, Ohio.

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Eleven Entirely New Ranges.

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71 STYLES,
**Listing from 75 Cents to $73.**

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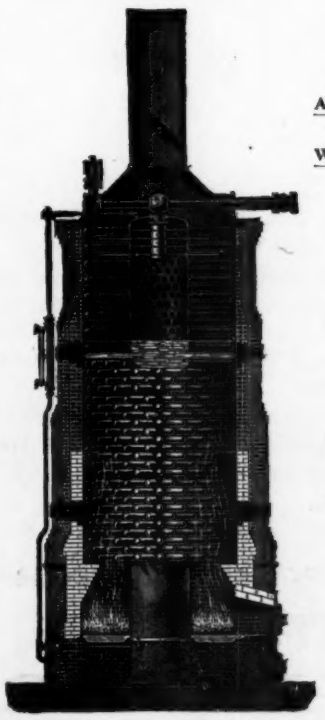
# The HAZELTON BOILER Frequently Called The PORCUPINE BOILER

**Patented in America and Abroad.**



## 100,000 HORSE POWER

of this Justly Celebrated Water-Tube Boiler in Successful Operation in all the Principal Industries.
An Unparalelled Record, of Over Twelve Years, for Economy, Durability, Safety, and Efficiency.
A Common-Sense High-Pressure Boiler made in a Superior Manner.
We Solicit for it the Critical Examination of the Mechanical Profession and the Steam-Using Public.

**THE HIGHEST STANDARD OF EXCELLENCE.**

**Standard Sizes, 50 H.P. to 500 H.P.**

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TRADE MARKS.

**Special Sectional Boilers For Export.**

**The only Genuine Hazelton or Porcupine Boilers bear our Three Registered Trade Marks.**

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This Company is prepared to Manufacture and Furnish Plants of Boilers of any desired capacity, and will forward proposals and other information on application. All imitations of the substantial features of this Boiler are infringements, and will be prosecuted to the full extent of the law.

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This Boiler is producing unequaled results in the works of most of the principal Gas Co.'s of the U.S., and in similar plants in Foreign Countries.

**NOT CONNECTED WITH ANY OTHER CONCERN IN THE UNITED STATES.**

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# THE BERLIN IRON BRIDGE CO.

The above illustration is taken from a photograph, and shows the Machine Room of the New Bedford Gas Co., at New Bedford, Mass. The Roof on this building was furnished by us. The building is 32 feet in width by 50 feet in length, the Roof being made entirely of iron—that is, iron trusses and iron purlins covered with corrugated iron. The room is ventilated by a wrought iron ventilator extending the full length of the building, with corrugated shutters on each side opening and closing by cords from the floor.

**Write for Illustrated Catalogue.**

**Office and Works, No. 6 Railroad Avenue, East Berlin, Conn.**

## HIGH CANDLE POWER

FROM

## GAS.

MR. WALTON CLARK, Assistant General Superintendent, United Gas Improvement Co.:

Dear Sir—In accordance with your request, I have made several tests of the new Welsbach mantel (called No. 169) for candle power and efficiency, and I herewith submit the following results:

| | Candle Power. | Pressure. | Gas Consumed. | C.P. per Cu.Ft. |
|---|---|---|---|---|
| Average of Test No. 1, | 67.05 | .95 in. | 2.6 | 25.70 |
| " " No. 2, | 63.86 | 1.00 in. | 2.86 | 22.30 |
| " " No. 3, | 72.50 | 2.1 in. | 2.87 | 25.26 |

The above averages are the results of trials on three different occasions, and in each case the mantles tested were made from a different lot of fluid.

The mantles used in the above tests were selected at random, and all had been dipped in kristaline and dried ready for shipment.

It is quite possible that better results could have been obtained by manipulating and readjusting the position of the mantles on the galleries, and also by waiting a longer period after burning off the kristaline; but I considered such fine adjustment undesirable in determining the commercial candle power.

These tests were made on a bar photometer against a regular Edgerton standard slit. The candle power of the slit was 6.18, and the gas used was Gloucester City water gas, 26 candle power.

Very truly yours,

(Signed) C. H. PAGE, JR., M.E.

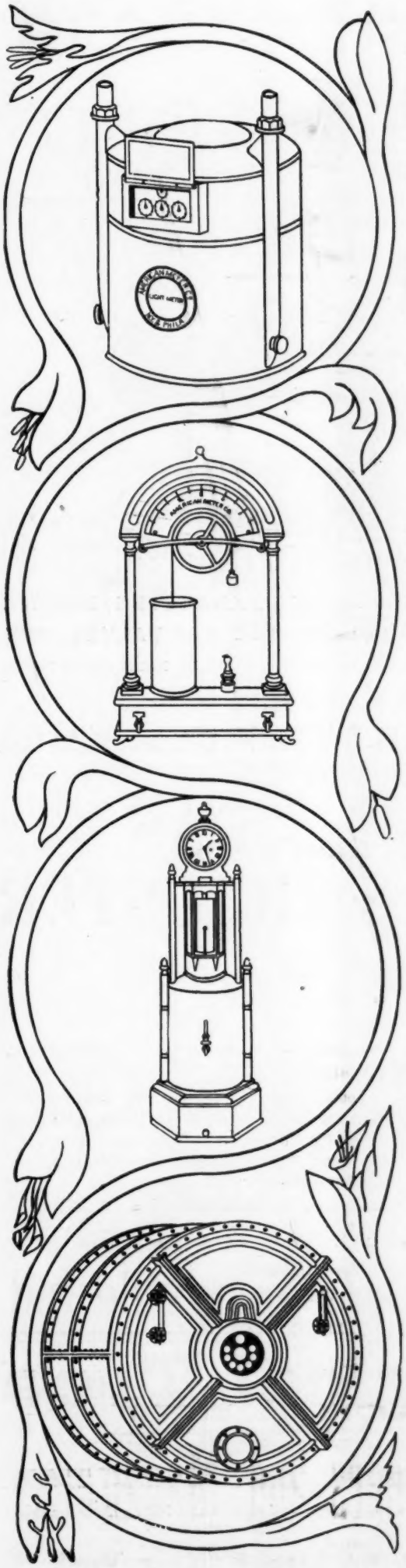
WE ARE NOW PREPARED TO FILL ALL ORDERS PROMPTLY FOR

**HIGH CANDLE POWER WELSBACH LIGHTS.**

**Gloucester, N. J. WELSBACH LIGHT CO.**

# Newbigging's Handbook for Gas Engineers and Managers.

The present (the fifth) edition marks an important advance on those that have gone before. Considerable additions have been made to the text, and much of it has been rewritten and otherwise improved. Price, cloth, $6. A. M. CALLENDER & CO., 32 Pine St. N. Y



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ESTABLISHED 1834. INCORPORATED 1863.

**NEW YORK and PHILADELPHIA.**

**CHICAGO, CINCINNATI,**

**ST. LOUIS, SAN FRANCISCO.**

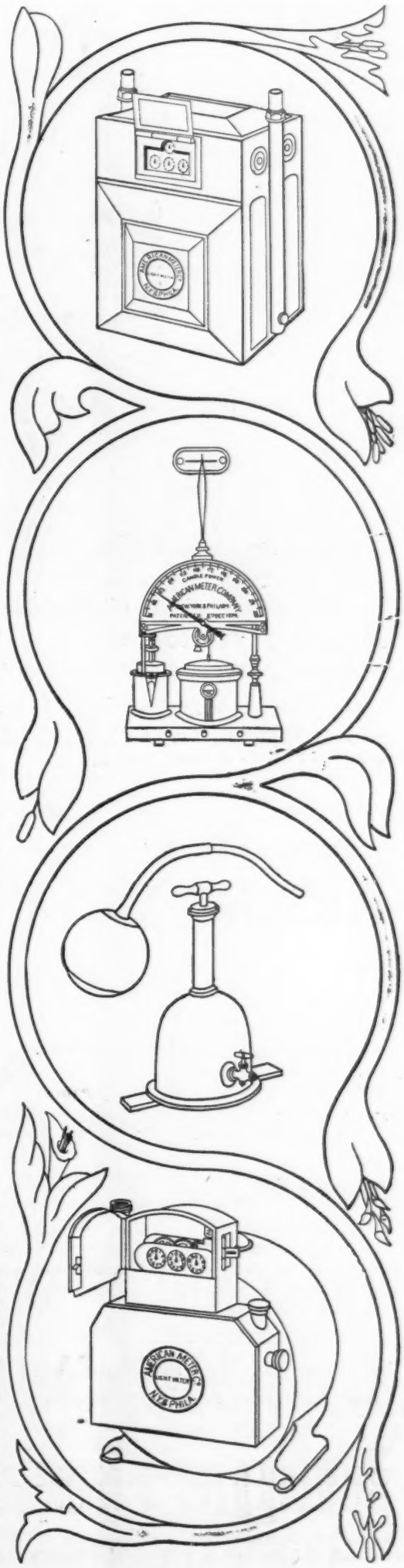
## PUBLIC LIGHTING TABLE.

### JULY, 1893.

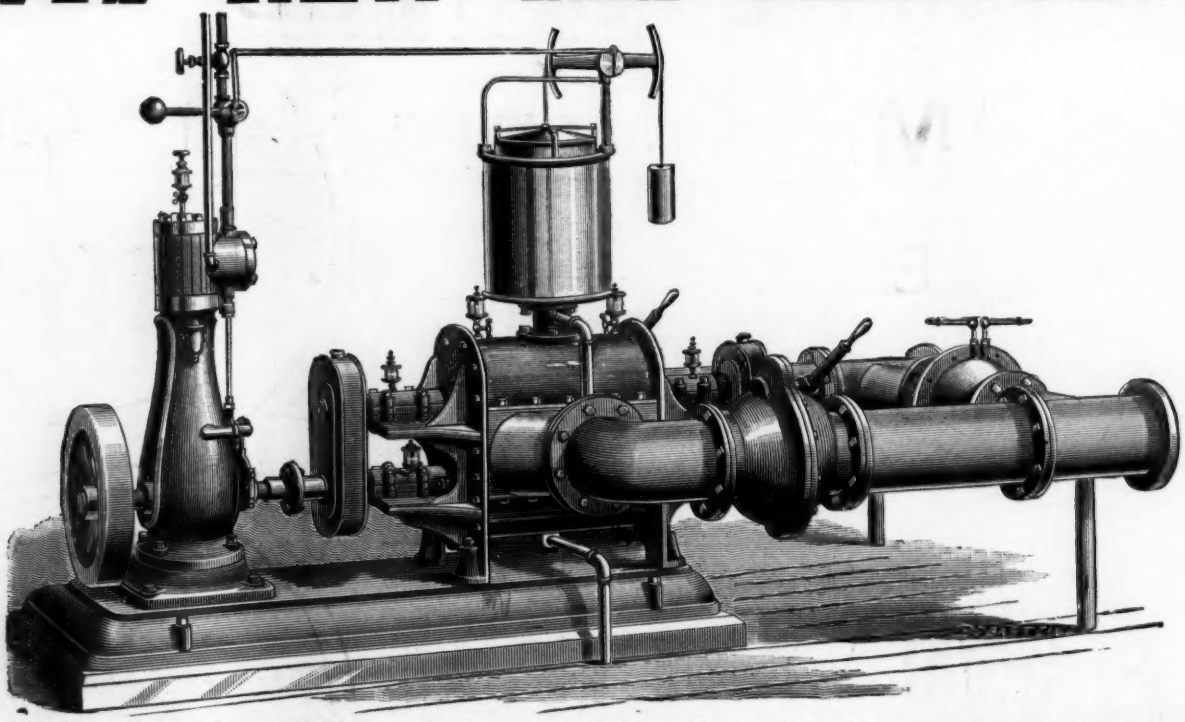
| Day of Week. | Table No. 1. FOLLOWING THE MOON. Date. | Light. | Extinguish. | Table No. 2. NEW YORK CITY. ALL NIGHT LIGHTING. Light. | Extinguish. |
|---|---|---|---|---|---|
| | | | | P.M. | A.M. |
| Sat. | 1 | 8.00 PM | 10.40 PM | 7.30 | 3.15 |
| Sun. | 2 | 8.00 | 11.10 | 7.30 | 3.15 |
| Mon. | 3 | 8.00 | 11.40 | 7.30 | 3.15 |
| Tue. | 4 | 8.00 | 12.00 | 7.30 | 3.15 |
| Wed. | 5 | 8.00 | 12.20 AM | 7.30 | 3.15 |
| Thu. | 6 | 8.00 LQ | 12.40 | 7.30 | 3.15 |
| Fri. | 7 | 8.00 | 1.10 | 7.30 | 3.15 |
| Sat. | 8 | 8.00 | 1.40 | 7.30 | 3.15 |
| Sun. | 9 | 8.00 | 2.20 | 7.30 | 3.15 |
| Mon. | 10 | 8.00 | 3.40 | 7.30 | 3.15 |
| Tue. | 11 | 8.00 | 3.40 | 7.30 | 3.15 |
| Wed. | 12 | 8.00 | 3.40 | 7.30 | 3.15 |
| Thu. | 13 | 8.00 NM | 3.40 | 7.30 | 3.15 |
| Fri. | 14 | 8.00 | 3.40 | 7.30 | 3.15 |
| Sat. | 15 | 8.00 | 3.40 | 7.30 | 3.15 |
| Sun. | 16 | 8.00 | 3.40 | 7.20 | 3.15 |
| Mon. | 17 | 8.00 | 3.40 | 7.20 | 3.15 |
| Tue. | 18 | 9.40 | 3.50 | 7.20 | 3.15 |
| Wed. | 19 | 10.00 | 3.50 | 7.20 | 3.15 |
| Thu. | 20 | 10.20 FQ | 3.50 | 7.20 | 3.15 |
| Fri. | 21 | 10.50 | 3.50 | 7.20 | 3.15 |
| Sat. | 22 | 11.10 | 3.50 | 7.20 | 3.15 |
| Sun. | 23 | 11.50 | 3.50 | 7.20 | 3.15 |
| Mon. | 24 | 12.30 AM | 3.50 | 7.20 | 3.15 |
| Tue. | 25 | 1.20 | 3.50 | 7.20 | 3.15 |
| Wed. | 26 | 2.10 | 3.50 | 7.20 | 3.15 |
| Thu. | 27 | No L. | No L. | 7.20 | 3.15 |
| Fri. | 28 | No L. FM | No L. | 7.20 | 3.15 |
| Sat. | 29 | NoL. | No L. | 7.20 | 3.15 |
| Sun. | 30 | 7.50 PM | 9.40 PM | 7.10 | 3.30 |
| Mon. | 31 | 7.50 | 10.00 | 7.10 | 3.30 |

### TOTAL HOURS LIGHTING DURING 1893.

| By Table No. 1. | Hrs.Min. | By Table No. 2. | Hrs.Min. |
|---|---|---|---|
| January... | 217.30 | January... | 423.20 |
| February.. | 200.30 | February.. | 355.25 |
| March .... | 177.50 | March .... | 355.35 |
| April..... | 160.30 | April..... | 298.50 |
| May..... | 149.00 | May..... | 264.50 |
| June..... | 140.30 | June..... | 234.25 |
| July..... | 143.40 | July..... | 243.45 |
| August.... | 154.50 | August.... | 280.25 |
| September. | 171.50 | September. | 321.15 |
| October.... | 202.20 | October.... | 374.30 |
| November. | 221.30 | November. | 401.40 |
| December. | 248.50 | December. | 433.45 |
| Total.. | 2188.50 | Total.. | 3987.45 |



# ROOTS' NEW GAS EXHAUSTER.



We will take pleasure in furnishing estimates on complete plants, including **GAS EXHAUSTER, ENGINE, and GAS GOVERNOR,** all connected, complete, on same bedplate. Also, estimates for **GAS VALVES, BYE-PASS VALVES, and PIPE FITTINGS,** arranged in any manner to suit the exhauster room or main connections.

All flanges of pipe and valve fittings faced off, with bolt holes drilled, all ready to go together.

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THE MOST ECONOMICAL, .
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# GAS EXHAUSTER

NOW ON THE MARKET.

The attention of Gas Engineers and Manufacturers is respectfully invited to our new

**CYCLOIDAL EXHAUSTER,**

the internal operating parts of which consist of two Revolvers, each p'aned accurately on cycloidal lines, the only Exhauster so constructed.

SIMPLICITY * EFFICIENCY * DURABILITY.

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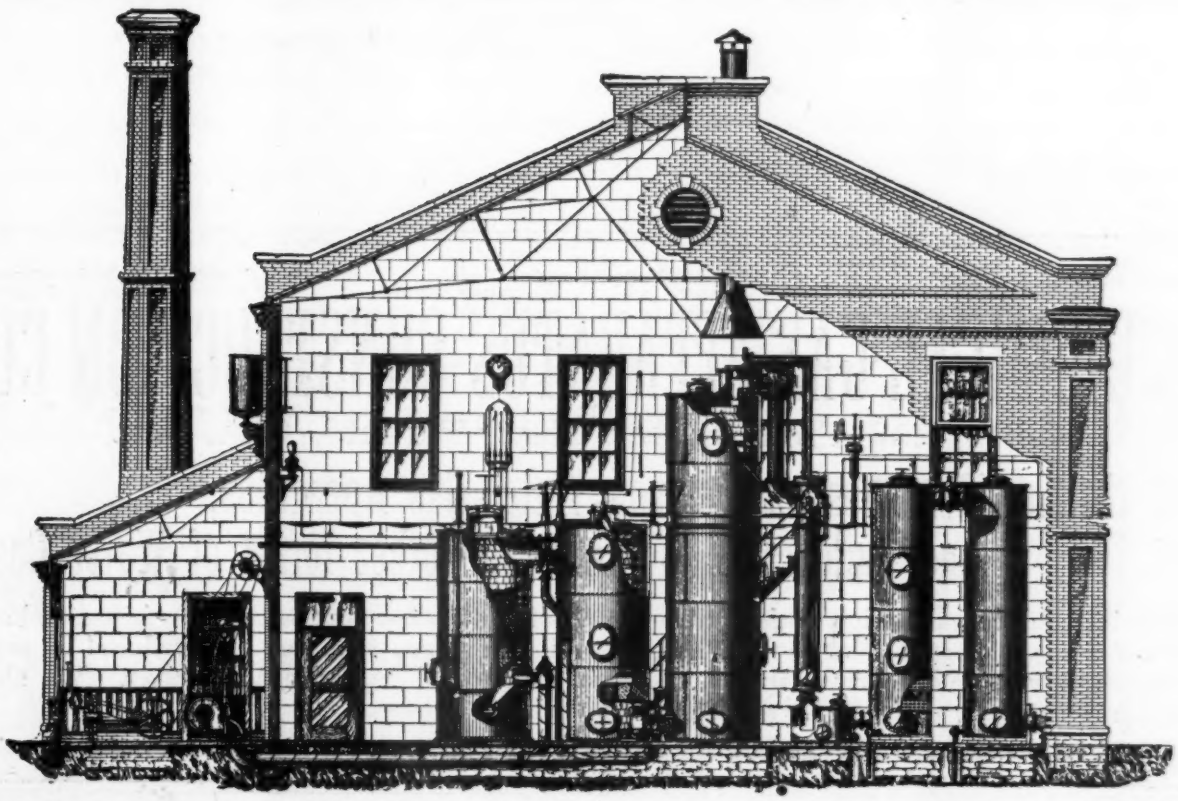
## THE STANDARD LOWE WATER GAS APPARATUS.



Standard "Double Superheater" Lowe Apparatus, designed for the use of Naphtha, Crude Oil, or "Distillates."

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Water Gas Plants, either independent or auxiliary to Coal Gas Works, erected to meet any conditions. Apparatus designed to use any grade of Oil, and Anthracite Coal, or Gas House or Oven Coke.

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ENGINEERS AND BUILDERS OF GAS WORKS AND APPARATUS.

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AMERICAN GAS LIGHT JOURNAL, New York City, N. Y.:

Gentlemen—We are in receipt of your favor of the 16th, advising us the National Gas Light and Fuel Company, of Chicago, will discontinue their advertisement from July 1st, and offering us the space occupied by them since 1885.

In thanking you for remembering us and for your kind expressions, it affords us great pleasure to advise you that we have decided to accept your proposition, as we fully realize the excellent advertising facilities afforded through the GAS LIGHT JOURNAL. In doing so we are also complying with repeated suggestions from the many friends we have gained in the fraternity, who have tried us with their orders. Our previous hesitancy in extending our advertising was due to the fact that, with our best efforts, we were unable to increase our facilities to meet the growing requirements; but with our new shop, to be completed this month, and which is being fitted up with special tools designed for the finishing of Gas Apparatus, we feel confident of being able to turn out all work intrusted to us promptly and in a first-class manner. We have taken the precaution to provide for any future extensions which may prove necessary. We now hope to extend our business relations with the fraternity, and will do our best to deserve it by prompt and first-class work and reasonable prices.

Yours very truly,
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By O. N. GULDLIN, Prest.

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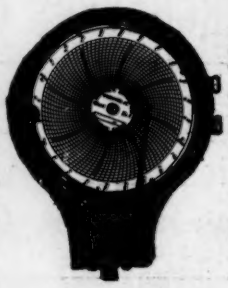

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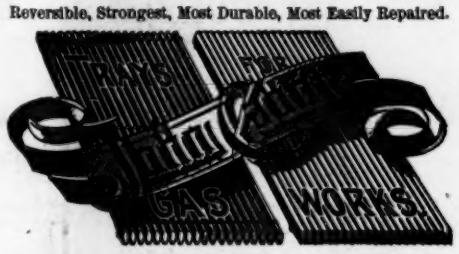


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WILL PAY FOR ITSELF WITHIN A YEAR! ITS SERVICE SECURES PERFECT DISTRIBUTION!
REDUCES LEAKAGE TO MINIMUM, and BENEFITS THE COMPANY and CONSUMER ALIKE!
IT IS THE ONLY RECOGNIZED AUTOMATIC GOVERNOR IN THE WORLD!

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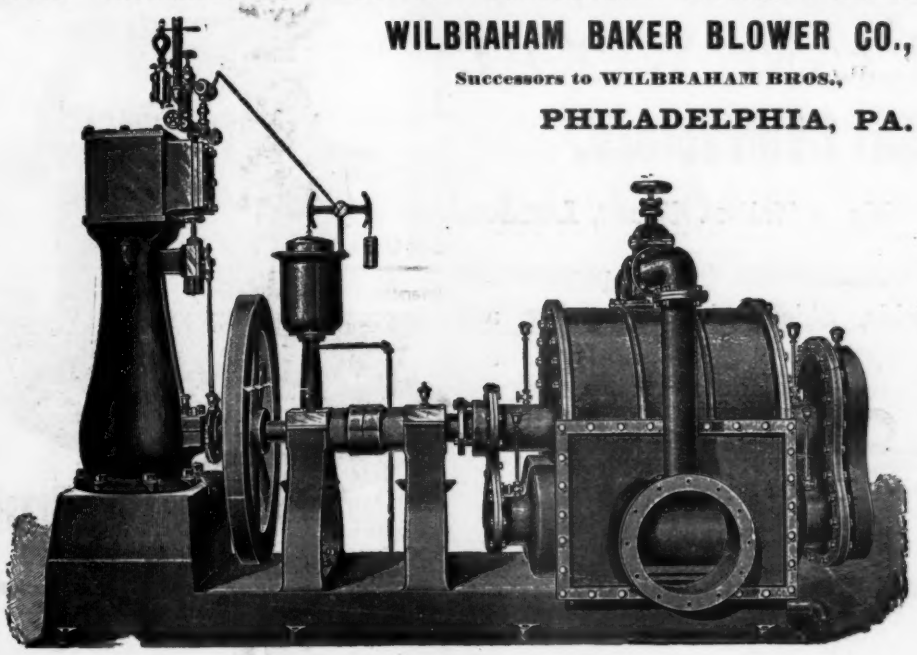

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Acts immediately, and more efficiently than any other purifying agent now in use.

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**For Gas Purification**

Is a superior natural Hydrated Oxide of Iron. Will give a higher purification per bushel than any other material. We ship the pure Oxide of Iron, containing no sawdust, thus effecting a saving in freight, leaving the consumer to furnish the diluent at a nominal cost. It is now used by the largest gas companies in the West.

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AN EQUIVALENT OF 627,650 CANDLE FEET,

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Single Carloads or more delivered at any required point in the United States or Canada.

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Proprietors of the **BATHVILLE COLLIERIES** (which produce the celebrated **BOGHEAD CANNEL**), Shields, Shieldmuir, Drumpeller, and other Collieries. This Firm offer

**STANDARD CANNELS,**

**Unequaled as Gas Enrichers.**

Analyses, prices, and all further information furnished on application to

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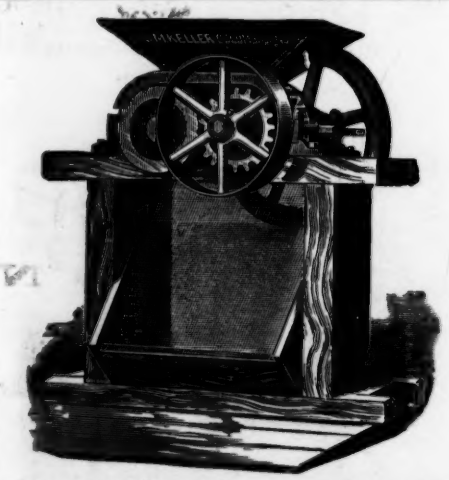

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**SIMPLE, STRONG, AND DURABLE.**

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**Correspondence Solicited.**

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**Coal, Carefully Screened & Prepared for Gas Purposes.**

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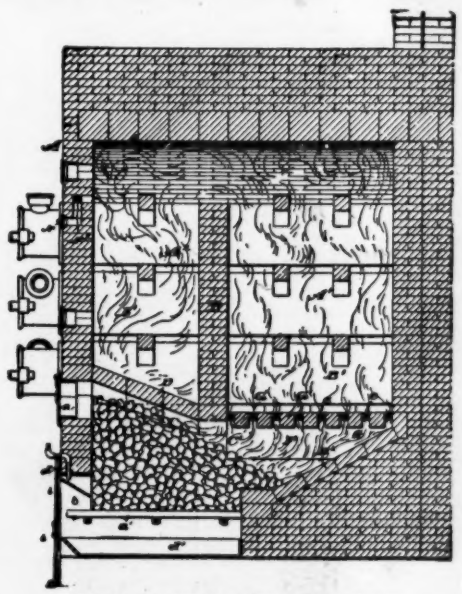

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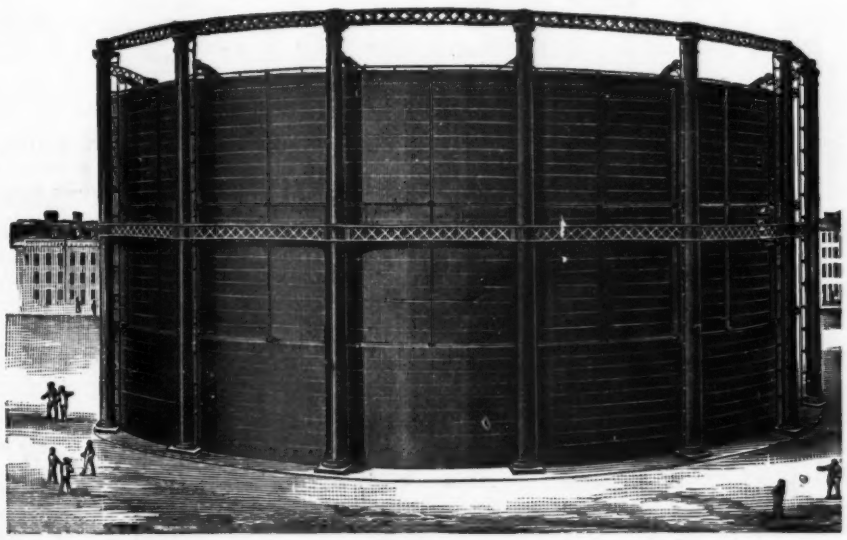

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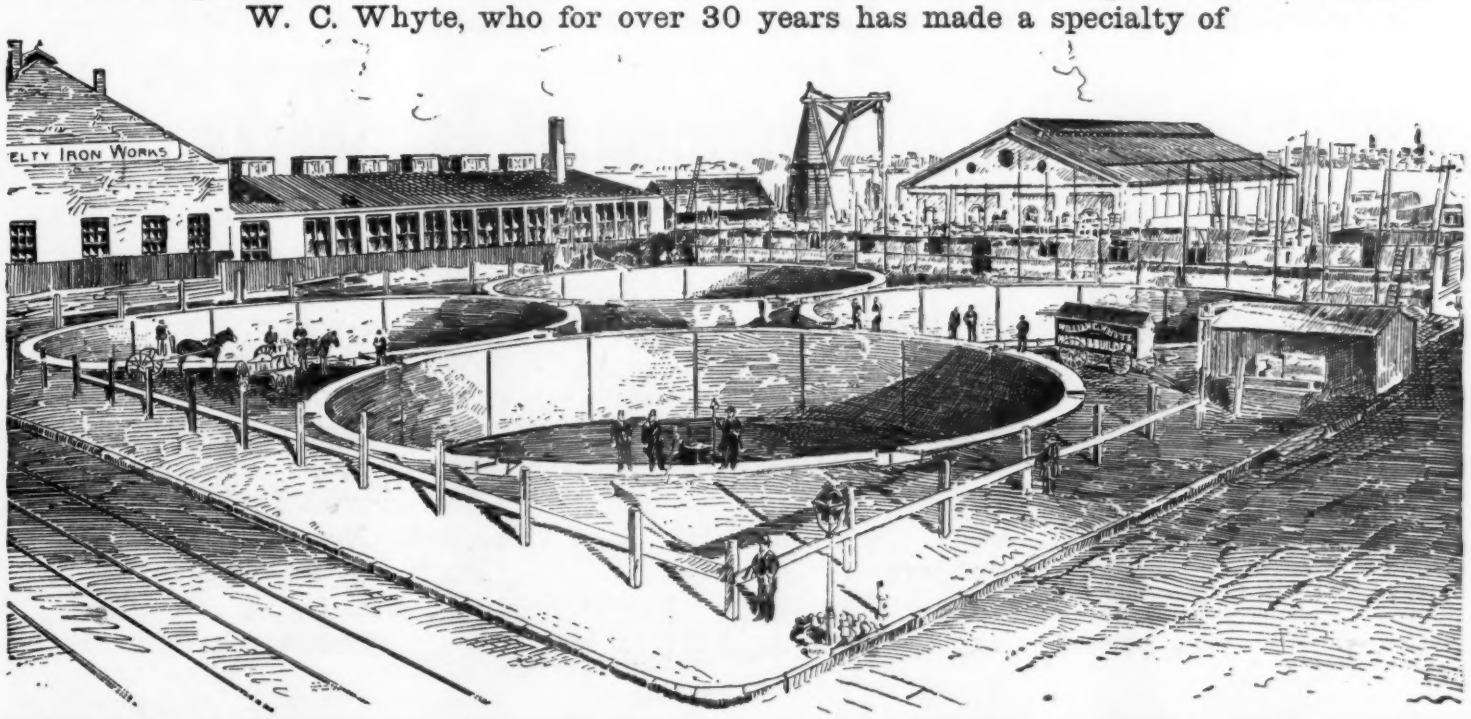


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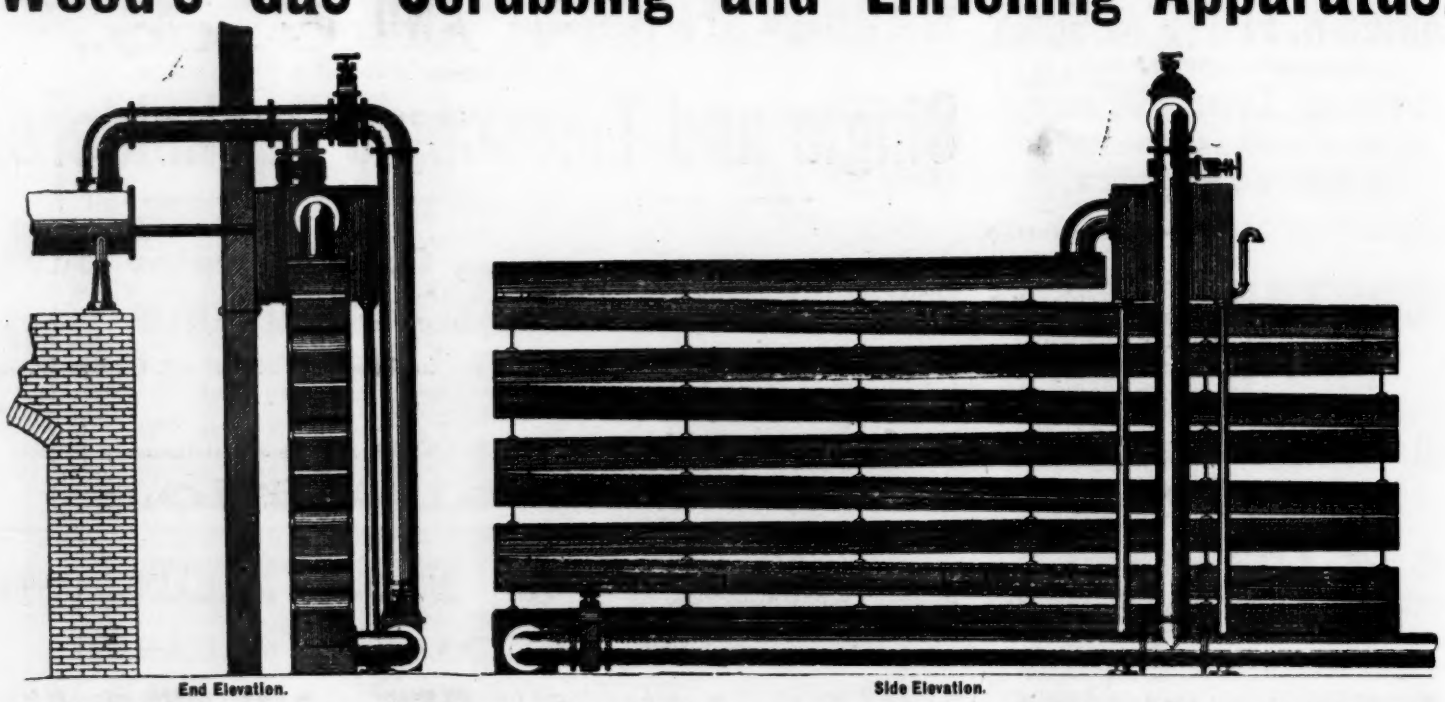

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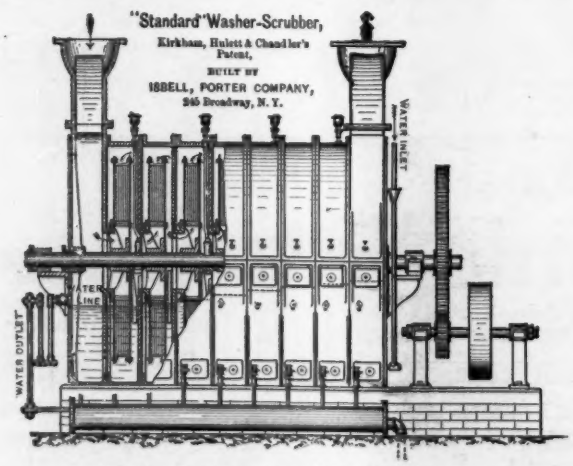


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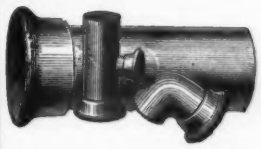

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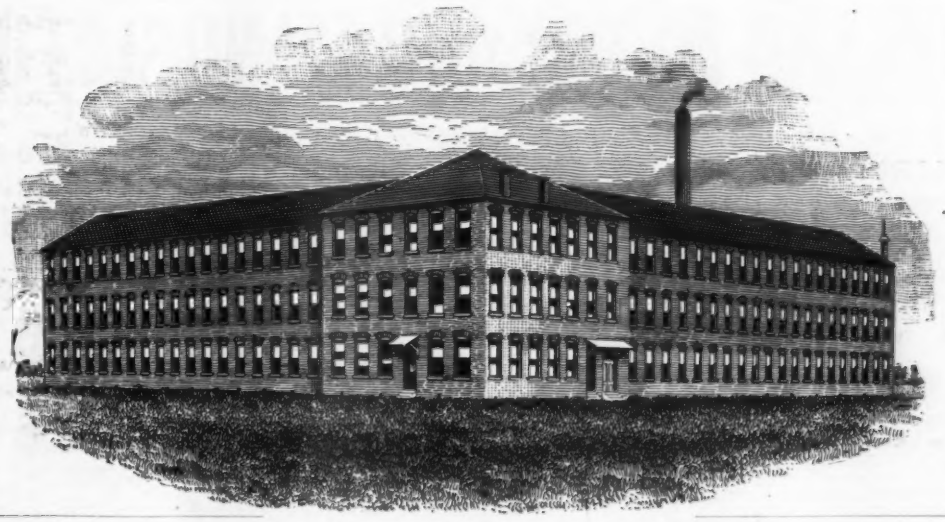

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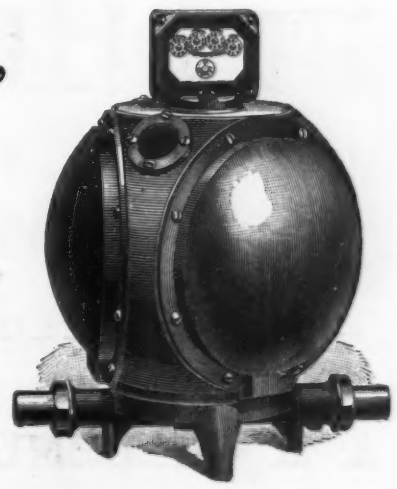

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## The Most Economical, Efficient, and Durable Gas Stove Made.

*SIZE.*

| *Stove.* | *Oven.* | *Broiler.* | *Top.* |
|---|---|---|---|
| 31 inches high. | 9¼ inches high. | 10 inches high. | 21 inches high. |
| 17 inches wide. | 15 inches wide. | 15 inches wide. | 16 inches wide. |
| | 12¾ inches deep. | 12¾ inches deep. | |

Length over extension shelves, 32 inches.

This Stove has three Boiling Burners in the Top or Hot Plate, and single Oven Burner.

The consumption of this Stove is 35 cubic feet per hour, at 1½ inch pressure with all burners.

Three-eighth inch supply pipe should be used when the pressure is 1½ inches or over.

ALL FITTINGS ARE NICKEL PLATED.

**Catalogue showing Styles and Prices sent free on application.**

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Station Meters (square, cylindrical, or in staves), Glazed Meters, King's and Sugg's Experimental Meters, Lamp Post Meters, etc., etc.

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**Pressure Gauges of all kinds, Pressure Registers, Pressure and Vacuum Registers, Pressure Indicators (sizes 4, 6 and 9 in.), King's Pressure & Vacuum Gauges.**

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